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THE PRAIRIE WOLF, OR COYOTÉ: CANIS LATRANS.

BY DR. ELLIOTT COUES, U.S.A.

A large amount of fresh material, gathered on the Upper Missouri, may furnish some data bearing upon the question, now agitated, of the resemblance of the coyoté to the dog of the bronze period. The examination is made of about twenty skins with skulls, and several specimens in the flesh. I compare them with a dog very nearly of the same size; selecting for this purpose a thorough-bred pointer—an animal which, in its enlarged brain-box, shortened muzzle, pendulous lips, long, loose, silky, drooping ears, close, glossy coat and rat-like tail, departs as much, perhaps, as any breed, from an original stock, in all the fortuitous points engrafted through domestication. Even in this case the likeness in all essential respects is striking; and, as shown in the sequel, specimens of Indian dogs of this region can be found not certainly distinguishable from a coyoté, for a reason that will be evident. The differences between the coyoté and pointer become reduced to character of pelage and physiognomy; while the facial aspect itself, so strikingly diverse in its entirety, appears, when analyzed, much less substantially different.

To begin with size and proportions: it appears from the following measurements that the pointer and coyoté differ less in these respects than the normal individual variation among coyotés them-

selves; and that there is no essential discrepancy whatever in general "build":—

COMPARATIVE MEASUREMENTS OF A MEDIUM SIZED MALE POINTER AND SEVERAL COYOTÉS OF BOTH SEXES.

The measurements are given in inches and decimals.

MEASUREMENTS.	Pointer ♂ Dog.	Large ♂ Coyoté. No. 2682	Medium ♂ Coyoté. No. 2735	Large ♀ Coyoté. No. 2732	Small ♀ Coyoté. No. 2731
Standing height at shoulder	24	24	21	22	19
Tip of nose to root of tail	36	36	33	34	28
Tail to end of vertebræ	13	14	12	14	11
Tail to end of hairs	14	18	15	16·50	13·50
Tip of nose to eye	4	4	3·75	4	3·50
Tip of nose to ear	8	.....	7·50	7·75	7
Tip of nose to occiput	9	8·50	8·25	8·50	7·50
Elbow to end of fore claws	14	13·25	12	12·50	11·50
Knee to end of hind claws	16	16·25	13·50	.....	.....
Heel to end of hind claws	8	7·25	6·75	7	6·50
Width across eyes at inner canthus	2·50	.....	1·60	.....	.....
Width across eyes at outer canthus	4·25	.....	3·25	.....	.....
Width across inner base of ears	6	.....	4	.....	.....
Height of ear above notch	5	.....	4	.....	.....
Width across tips of outstretched ears	15	.....	11·75	.....	.....
Greatest width of ear pressed flat	3·25	.....	3·25	.....	.....
Tight girth of muzzle at middle	8·50	.....	7·50	.....	.....
Tight girth of chest	26	.....	19	.....	.....
Tight girth of belly	23	.....	16·50	.....	.....
Longest hairs of back	1·50	.....	5	.....	.....
Width across hairs of tail pressed flat	.....	.....	8·50	.....	.....

The coyoté appears more stoutly built, but this is deceptive, owing to the dense furring; the various girths show the contrary. It is, however, somewhat more "compact," the limbs lacking a certain freedom of swing, if not being slightly shorter.

It would not be much to the point to compare the pelages, since the cultivated coat of the pointer differs quite as much from the shaggy one of numerous other dogs, as from that of the coyoté. It is interesting to observe, however, that even the closest-haired

pointer shows, in anger, a slight though decided "mane." The mane of the coyoté is very conspicuous, the longest hairs over the back measuring four to six inches. The furring of the tail is as extremely diverse. The tail of a coyoté ordinarily droops to the suffrago, the hairs reaching beyond half-way to the heels; it is perfectly straight; the "brush" is terete-tapering, perhaps not quite so full for its length as that of a fox: in absolute size it is just intermediate between that of a *Vulpes velox* and *V. macrourus*, both of which are smaller animals. But furring aside, we find in the total lack of curve in the thorough-bred pointer's tail, a curious coincidence if nothing more. This straightness, prized by sportsmen, the result of breeding, and often cruelly insured by removal of the terminal joints so that some of the tendons lose insertion, is a feature in which the pointer departs from most dogs (the curly tail has been laid down as a specific characteristic of "Canis familiaris"), and resumes that of the coyoté.

Fortuitous conditions of pelage aside, the physiognomy, an almost equally casual matter, is the most striking difference between the two. It is difficult to portray an animal's facial expression in words; in this case we can hardly do better than to say that the aspect is just between a wolf's and a fox's, but more "doggy" than either. Audubon's figure is good; if anything, the front view of the upper figure is too "foxy." The coyoté's face would be exactly matched by that of many cur-dogs, especially slender-nosed kinds, did it not lack almost entirely the frontal prominence of the latter, a feature which in some kinds of lap-dogs is exaggerated into monstrosity. The upper profile of the coyoté's face, from occiput to snout, deviates not much from a straight line, the forehead being remarkably flat. This flatness gives an appearance of breadth that is deceptive, the real width being both absolutely and relatively less than in the pointer. But the width across the ears of the pointer (six inches instead of four) is largely produced by the drooping of these organs down the side of the head. The lips are thin and scant, ordinarily showing th teeth, always parting after the animal is dead. There is something peculiar about the eyes; they seem to look more directly forward than those of the pointer. They are set very near together, the inner angles being only about an inch and a half apart, yet the obliquity carries the outer canthi over three inches apart. The ears are very large, triangular, pointed, upright, with very stiff

cartilage. When pressed apart, their tips form with the point of the snout a nearly equilateral triangle. In fine, the pointer's physiognomy differs from the coyoté's mainly in its special engrafted features, and these produce a discrepancy much greater than that existing between the coyoté and many mongrel dogs.

It is unnecessary to compare the skulls of the animals. There are no differences of moment, at least viewing the immense discrepancies existing in the crania of different breeds of dogs. Nor does an "average" dog's skull differ from a coyoté's by anything like as much as do the skulls of *C. latrans* and *C. lupus*.

It appears, then, that the pointer, though a highly specialized case of the domestic dog, is identical in essential structural points with the coyoté; differs less in size than coyotés vary among themselves; differs no more in pelage than it does from many other dogs; and, in details of form and physiognomy, differs vastly less than various dogs do among themselves. It appears, furthermore, that close as the likeness is, it is less than that subsisting between the coyoté and various kinds of dogs domesticated by the Indians.

For example, there is nothing in Audubon's description of the Hare-Indian dog specifically inapplicable to the coyoté. Even the colors are the same; the difference in pattern (masses of blackish instead of brindling) is not of the least consequence, since it is entirely unstable. Richardson noted close traits of resemblance, even to the remarkable mode of outcry—a few, short, sharp barks followed by a prolonged shrill howl. The fact that this particular strain of dog is bred beyond the present distribution of the coyoté, is, of course, not to the point in the general question. But we have much more striking and unquestionable evidence of relationship by direct descent of some Indian dogs from the coyoté. In the first place we should note that the habitual antagonism of these dogs and the coyotés is nothing but the animosity all dogs show to strangers of their own kind, an aversion probably rooted in jealousy, which is a strong canine trait. Next, we continually find dogs of both sexes, on the frontier, deserting their haunts at particular (sexual) periods; and if the occurrence of a feral wolf-dog (coyoté ♀ and dog ♂) has not been recorded, there are numerous cases of the production of the same (from coyoté ♂ and dog ♀) in domestication. I have, finally, information which I consider perfectly satisfactory, in still stronger evidence of the readiness with which the two animals interbreed. Indians not unfrequently bring it

about themselves; on suitable occasions they picket out their ♀ dogs over night, to procure the cross, with constant success. What profitable quality is secured, I do not know; but such is the case. These crosses are not known to be otherwise than fertile; and the result is, in every Indian community there are mongrel dogs shading into coyotés in every degree; all having the clear wolf strain, and some being scarcely distinguishable from a prairie wolf.

The matter of color merits passing mention. The coyoté is as constant in this respect as other feræ, and I think its peculiar coloring can be reasonably traced in certain dogs. The animal is dingy white as a ground color, which remains so on all the under parts; above it is suffused with tawny-brown (bright in summer, paler and more grayish, or quite gray, in winter), this color overlaid with a clouding of black. This black is rarely uniformly distributed; it tends to streakiness along the back and across the shoulders and hips, producing a pattern similar to that of a "brindled" bull-dog. But there is a more striking feature, and one very characteristic of the animal (the brindled gray and black being shared exactly by an ordinary strain of *C. lupus*). The top of the muzzle, back of the ears, and outside of both fore and hind legs, are usually nearly uniformly tawny. This shade is precisely the so-called "tan" of the black-and-tan terrier, and has the same general distribution. In an attempt to trace pedigree, a fact of this sort seems to rank in value with the appearance, in a horse or mule, of the stripes of a quagga-stock.

THE IRREGULAR MIGRATIONS OF BIRDS.

BY T. MARTIN TRIPPE.

The annual migration of birds; their moving north and south in the spring and autumn, is obvious enough to every one. In its various phases it is well discussed in various ornithological works, and is pretty thoroughly understood, comparatively speaking at least. But in addition to their vernal and autumnal changes of habitat, movements occasionally take place among birds not depending upon the seasons; invasions as it were of certain prov-

inces where they were before unknown, and a disappearance from their former range. Similar movements take place and, indeed, are constantly going on, among all ranks of the animal and vegetable kingdoms, though owing to their preëminent mobility, birds afford the most conspicuous examples, excepting, perhaps, the class of insects. The slow but sure progress of the Norway rat from the east is well known, it having gradually spread itself in the course of one hundred and fifty years, from Persia to the Pacific Ocean. The steady eastward march of the Colorado potato bug is another example, while among plants, *Leucanthemum vulgare* and *Rudbeckia hirta* afford familiar instances.

Audubon speaks of the chestnut-sided warbler as one of the rarest Sylvias of his day. In his "Ornithological Biography," he tells us that he searched for it for years in vain; and finally on obtaining five specimens in the same spring, considered himself extremely fortunate. At the present day it is, in the very regions where Audubon spent years in collecting, one of the commonest warblers; and the most inexperienced collector could shoot, not five, but five hundred in one season; indeed I have seen it far outnumbering all the other species together, and literally swarming in the woods. At the same time, the mourning warbler, rare in the time of Wilson and Audubon, remains quite as much so still; only in certain other localities it has been found very abundant. Now it is not to be supposed that the former species could have been common in the eastern states, and yet have eluded the observation of Audubon; and it is not at all probable that their present abundance is owing to the natural increase of the species. Plainly there must have been a migration or extension of range from some other region where it was at that time abundant; and in the same manner the next fifty years may see the mourning warbler extending its limits further and further eastward from Minnesota, where it is now common, until it is as abundant in the Atlantic States as the chestnut-sided warbler.

A somewhat similar case, but occurring in a much more limited space of time, happened in my own experience. In a series of several years' close observation at Orange, New Jersey, I searched for the great-crested flycatcher (*Myiarchus crinitus*), year after year, but all in vain; and what made the fact very singular was, that twelve or fifteen miles off, I had seen the bird sufficiently often to convince me that, if not common, it was by no means rare. Yet

for some inexplicable reason it did not inhabit the country immediately about Orange, for, although in the woods nearly every week for years, I never saw it until, after I had almost despaired of ever finding it, I did succeed in shooting a single specimen. This was in the fall; the next spring I saw a pair. In the summer, I went away; and, after an absence of two years, returning to Orange, I strolled through the woods, my old hunting grounds, and, to my surprise, almost the first bird I saw was the great-crested flycatcher. Subsequently I scarcely ever took a walk through the woods, without seeing or hearing it.

Now for what reason it had neglected quite an extensive range, in every way suited for its habits, and what impelled it so suddenly to invade and occupy that region, I cannot possibly imagine, as the woods had undergone but little change in that brief period and that little by no means prejudicial to its habits.

The purple finch was another instance of the same character, though less striking, from its known erratic disposition. For three years, I never saw more than a single pair; then it made its appearance during an unusually cold and stormy fall, in large numbers, and after that, for several years it was a regular spring and autumn visitor, so that I came to look for it as regularly as the robin or fox sparrow. The pine finch, also erratic, I never saw at all, for five years; then it appeared in great numbers just before a severe winter, and thereafter, for a space of several years, it was a regular winter visitor, staying till late in March, and coming as regularly in mild seasons as in cold.

In the time of Wilson, the redheaded woodpecker was one of the very commonest birds of the orchard and farm; and so abundant and familiar were they that, at the time of his writing his account of that bird, he says he knew of several nests within a few miles of Philadelphia. At the present day however, the redheaded woodpecker is not a frequent bird in the vicinity of towns and villages of the regions of which Wilson wrote. At Orange, I never saw more than a dozen individuals in any one year; and all of these, with very few exceptions, were young birds in the fall, found with few or no exceptions, on the edges of heavy timber, and never in orchards or anywhere near the outskirts of villages. I do not speak from very extended experience, but in the course of many pedestrian tours through northern New Jersey and southeastern New York, I never found this bird either common or familiar.

Yet at the west, it has now exactly the habits described by Wilson, frequenting the orchards and coming into the busiest streets of considerable towns with the freedom and unconcern of the warbling vireo and chipping sparrow; indeed, so familiar are they that they frequently alight on the roofs of houses, and tap on the shingles, looking down occasionally, with the utmost *sang froid*, upon the passers-by. Here, if I mistake not, is a gradual withdrawal from certain regions of country, and a change in the habits of those few remaining.

A similar disappearance has taken place, from some localities at least, of the hairy woodpecker. Of this bird I never shot more than a single specimen at Orange, though hunting for it for many years, through quite an extensive range suitable for its habitat. Yet according to Wilson, it was everywhere one of the most abundant and familiar birds in the Atlantic States; an observation indeed, made by other authors, and which I have confirmed myself at several points, yet for some unaccountable reason it has failed to take possession of a considerable region, admirably adapted apparently to his habits; or, if it ever did occupy it, for some equally unaccountable cause, has almost wholly deserted it.

The Carolina parrakeet is another instance of a gradual withdrawal from a former range, the bird rarely appearing now, where formerly it was quite abundant. This may be partially accounted for indeed, by the settlement of the country; the valley of the Ohio, where it was formerly common, having, in the course of half a century, been converted from a wilderness into a thickly settled country. But this explanation is only partially satisfactory; for in its former range are still large tracts of almost primitive wilderness, where it might find every requisite for its existence.

In certain portions of Colorado the raven is now a rare bird where, as the miners have informed me, it was very common, fifteen, or even ten years ago.

Some of these migrations may be easily explained. Many of them occur through human agency; others through climatic modifications. As the settlement of the western frontiers extends, the quail and the prairie hen, finding abundance of food, extend their range correspondingly; and as trees are planted on the plains,*

*A curious question arises here. The vast tract of treeless prairie lying between the Missouri river and the Rocky Mountains, forms at present, a very complete barrier between the sylvan species of the two regions, which they seldom cross; but as the settle-

the insectivorous and arboreal species will become abundant in regions where they previously could not exist. The destruction of forests, and the draining of swamps must, of course, result in the diminution of the numbers of the forest and swamp loving species, as seen very plainly in England at the present day; and again, the protection afforded from predaceous animals, by the presence of man, and the thinning out of birds of prey, must necessarily result in a great increase of the smaller and inoffensive tribes. On the other hand, the persecution to which certain species, mainly rapacious, or valuable for food, are subjected, results in their thinning out or even extermination, unless, as often happens, they migrate to other and wilder regions.

Climate influences many extraordinary migrations. A severe winter will cause northern birds to migrate much further south than usual, and a long hot summer will entice southern birds to visit us, which we do not see in ordinary seasons. Such migrations, however, are only temporary, although I am inclined to think that birds may subsequently revisit regions, purely from choice, to which in the first place, they were compelled to fly for safety. And again, extraordinary seasons may have an indirect influence upon these movements of birds. In a recent interesting little article in the NATURALIST, Prof. Shaler shows how the flora of New England was probably modified by the recent cold winter; and of course, a modification of the flora would result in a corresponding modification of the avi-fauna. Thus, the coniferous trees being reduced in numbers, there would be a similar reduction in the abundance of pine grosbeaks, finches, crossbills, and other species, more or less dependent upon the *Coniferæ* for food. The insect fauna also, closely connected with, and necessarily affected by the slightest change in the flora, must undergo some readjustment, resulting in a corresponding change among the insectivorous birds.

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ment of the plains proceeds and trees are planted, this barrier will gradually cease to exist, and the arboreal faunæ of the Rocky mountains and the east will extend their limits and meet each other. What will be the result on such allied congeneric species or varieties as *Oporornis agilis* and *O. McGillivrayi*, *Sitta Carolinensis* and *S. aculeata*, etc? Will each preserve its characteristics; or will a hybrid race arise, completely merging the one into the other? *Sturnella Ludoviciana* and *S. neglecta*, usually regarded at the present day as varieties of the same species, exist side by side, retaining in a general way at least, certain peculiar notes and habits. On the other hand, *Colaptes auratus* and *C. Mexicanus*, universally admitted as valid species, blend into one another by imperceptible gradations in regions where their habitats adjoin.

In many cases, however, it seems impossible to assign any reason for these irregular migrations. What caused the chestnut-sided warbler to become so abundant in the eastern states, where it formerly was so rare; what influenced the Carolina parrakeet and the raven to desert regions where they were once common; and what caused the appearance of the great-crested flycatcher about Orange, where for years it had not been seen; and why the hairy woodpecker shuns the same region, are questions that will puzzle an ornithologist to answer. Certainly, in none of these cases, was persecution, or lack of proper shelter and food, or change of climate the impelling cause. It may have been the same motive that influenced them, that ofttimes has impelled the races of men to migrate *en masse*, as in the days of the Huns and Goths,—the mere desire to see and possess new countries, with the vague expectation of bettering their condition thereby. Certain it is that, whatever the motive, the tribes of birds migrate here and there, invade and hold new regions, and disappear from others; and move to and fro, upon the face of the earth, in the same manner as do the tribes of men.

DISCOVERY OF AN OCTOPUS INHABITING THE COAST OF NEW ENGLAND.

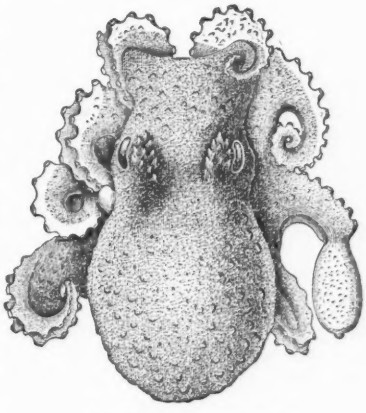
BY PROF. A. E. VERRILL.

One of the most interesting of the numerous discoveries made during the dredgings carried on in the Bay of Fundy last summer, in connection with the work of the U. S. Fish Commission, was a fine new species of Octopus (*O. Bairdii* Verrill) which inhabits the deeper waters of that region. It seems to be not uncommon below seventy-five fathoms, judging from the fact that we met with it in five different localities. All the specimens obtained were males, and it is probable that the females are much larger than the males, as in other species of the genus.

Most of the specimens were kept alive for several days, in order to observe its habits. Several good drawings were made by Mr. J. H. Emerton, showing its different attitudes. When at rest it remained at the bottom of the vessel, adhering firmly by some of

the basal suckers of its arms, while the outer portions of the arms were curled back in various positions; the body was held in a nearly horizontal position and the eyes were usually half-closed and had a sleepy look; the siphon was usually turned to one side and was long enough to be seen in a view from above (Figs. 76 and 77).

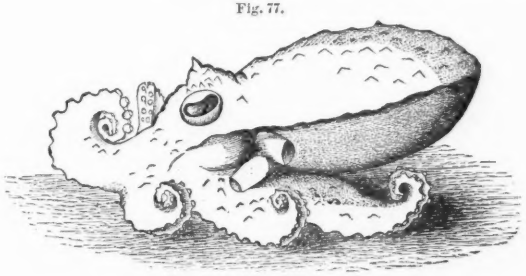
Fig. 76.



Octopus Bairdii. Dorsal view.

When disturbed, or in any way excited, the eyes opened more widely, especially at night; the body became more contracted and rounded, and was held more erect; the small tubercles over its surface and the larger ones above the eyes were erected, giving it a very decided appearance of excitement and watchfulness. It was rarely, if ever, observed actually to creep about by means of its arms and suckers, but would swim readily and actively, circling around the pans or jars in which it was kept many times before resting again. In swimming backward the partial web connecting the arms together was used as an organ of locomotion, as well as the siphon, for it and the arms were alternately spread and closed, the closing being done energetically and

Fig. 77.



Octopus Bairdii. Side view.

coincidently with the ejection of the water from the siphon, and the arms after each contraction were all held pointing straight forward in a compact bundle, so as to afford the least resistance to the motion. As the motion resulting from each impulse began to diminish sensibly, the arms were again spread and the same action repeated. This action of the arms and web recalled that of the disk of the jelly fishes, only it was much more energetic.

The siphon was bent in different directions to alter the direction of the motions, and by bending it to the right or left side, backward motions in oblique or circular directions were given, but it was often bent directly downward and curved backward so that the jet of water from it served to propel the animal directly forward. This, so far as observed, was its only mode of moving forward. This mode of swimming forward has previously been observed in cuttle-fishes (Sepia) and in squids (Loligo). This species was much more active and animated in the night than during the day, and is probably nocturnal in its habits, when at home. None of the specimens could be induced to take food, and none survived more than four or five days, although the water was frequently renewed to keep it cool and pure. They were rather roughly handled by the dredge, without doubt.

The following description is from the "American Journal of Science," for January, 1872:—

"The body is short, thick, somewhat depressed, broadly rounded posteriorly, separated from the head only by a slight constriction at the sides. Head almost as broad as the body, swollen above and around the eyes, concave in the middle above; around the eyes, and especially in front and above, there are numerous small conical, often irregular and rough tubercles; and a little removed from the upper side of each eye is a much larger, rough, irregularly conical, erectile tubercle, which has some small, more or less prominent, conical tubercles on its surface; the whole upper surface of the body, head, and arms is also covered with minute scattered tubercles, which are usually but little prominent. Siphon large, tapering, capable of being bent in all directions, so as to be used for swimming both forward, backward, and sideways, according to its direction. Arms subequal, relatively short, stout, tapering to slender points, connected for about one-third of their length by a web, which extends as a narrow membrane along their margins to near the ends. Suckers small, not crowded, alternating pretty regularly in the two rows; the arms of the first pair each have about sixty-five suckers; those of the fourth pair about sixty. The right arm of the third pair has its terminal portion, for about

a third of its entire length, modified for reproductive purpose into a large spoon-shaped organ, broadly elliptical in outline, with the sides incurved, somewhat trilobed at the end, deeply concave within, where there are nine or ten elevated transverse folds; at the base there is a fold bent into an acute angle, the apex directed forward, leaving a deep V-shaped sinus behind it, which is in continuation of a shallow groove formed by a thickening of the web along the side of the arm and terminating midway between it and the fourth arm; at the end, the arm terminates in a small conical tip, between the two broadly rounded lobes of the spoon-shaped organ; at the base of this organ there is a slight constriction, below which the basal portion bears about thirty-one suckers, like those on the other arms. The modified portion of the arm is considerably longer than the distance between the constriction at its base and the interbrachial web, and equal to one-half the total length of the part which bears suckers. The corresponding arm on the left side is of the ordinary form and has about fifty-one suckers. Length of the largest specimens, in alcohol, exclusive of the arms, 1·75 inches; breadth of the body 1·25; between eyes ·7; length of the arms of the first pair, from mouth, 2·25; from mouth to edge of the web ·70; length of modified portion of third right arm ·70; breadth of this organ when expanded ·45.

When living the color was usually pale, translucent, bluish-white, thickly specked with light orange-brown and dark brown. Off Head Harbor, Campo Bello I., in seventy-five and eighty fathoms, shelly; off Herring Cove in sixty fathoms, muddy; off Grand Menan in one hundred and six fathoms, gravel and sand.

I first dredged this interesting species while on the "Mosswood," in company with Professor Baird, in honor of whom I have named it. It is somewhat related to *O. Grœnlandicus* Dewh., but the male of the latter has the third right arm much longer, with the modified portion relatively very much smaller and quite different in form, and with more numerous folds, and the basal part bears forty-one to forty-three suckers; the other arms also have more numerous suckers; the web is less extensive and the body is more elongated. There is no other species known on the American coast, north of Cape Hatteras. The southern species is very much larger and very different in many respects."

THE HOMOLOGIES OF PEDICELLARIÆ.

BY ALEXANDER AGASSIZ.

O. F. Müller, in his "Zoologia Danica" was the first to point out the existence of certain organs in sea-urchins which have long remained a puzzle to naturalists. To these organs he gave the generic name Pedicellaria, and considered them as parasites of the sea-urchins. Of his genus Pedicellaria he describes three species which are now known to be either different stages of development, or different kinds of pedicellariæ, situated in various parts of the shell of the sea-urchin. Our knowledge of the pedicellariæ is now materially changed, first by the views of Delle Chiaje, who, in 1825, figured and described the pedicellariæ of several sea-urchins and starfishes. He however no longer considers them simple parasites but says distinctly that they form a part of the test of the Echinoderms and help them in seizing their prey and taking hold of adjoining bodies. Much of this view has been corroborated, and like many of the shrewd observations of Delle Chiaje is gaining only now the recognition it should have received long ago. Valentin in 1841 gives in his "Anatomy of Echinus" excellent figures and descriptions of pedicellariæ which he considers as organs of prehension. Agassiz at that time suggested the possibility of their being young stages of Echinoderms, in consequence of the discoveries then made by Sars of the remarkable development of a species of starfish. This, it is needless to say, is a view he has long ago abandoned though he is most persistently credited with it even at the present time. Subsequently, Erdl, Duvernoy, Müller and Troschel, Sars, Stimpson, Norman and Stewart have figured a number of pedicellariæ of Echini and starfishes, and have made a more or less successful attempt to use their characters as aids in distinguishing closely allied species. An article on pedicellariæ in the "Annales des Sciences Naturelles" for 1869, by Perrier, gives a large number of excellent figures of the pedicellariæ of starfishes and sea-urchins; unfortunately, except as a mere accumulation of facts, it is useless, the writer ignoring what had been done for the last twenty years, on the very appendages he was describing, so that he leaves the question of their nature

as it stood in the days of Valentin in spite of the many observations made, and hints of their true nature thrown out by Müller, Troschel, Sars and A. Agassiz, which would have saved Perrier much useless speculation.

Fig. 78.

No attempt has yet been made to ascertain the homologies of these organs, and the present article is intended to give the results which have been reached by the writer since 1864, from the study of the embryology of starfishes and Echini.

Fig. 79.

If we examine the common sea-urchin of the coast of New England, we shall find, scattered in between the spines over the whole surface of the shell, numerous pedicellariæ (Figs. 78 and 79). They consist of a calcareous stem (Fig. 80) articulating at its base upon a small granule of the test; this is surrounded by a muscular sheath expanding into a somewhat swollen portion with a thimble-shaped knob at the end. This knob, though it seems solid and compact at first sight, is in reality split into three wedges (Fig. 81 *a*), which can be opened and shut at will. When open, these pedicellariæ may be compared to a three-pronged fork, except that the prongs are arranged concentrically instead of on one plane and when closed they fit into one another as neatly as the pieces of a puzzle. Fig. 81 represents the end view of one of these pedicellariæ.

Fig. 81 *a*.

Fig. 80.

If we watch a sea-urchin after he has been feeding, we shall learn at least one of the offices which this singular organ performs in the general economy of the animal. That part of the food which he ejects passes out of the anus, an opening on the summit of the body in the small area where the zones of which the shell is composed converge. The rejected particles, thrown out in the shape of pellets, are received on these little forks which close upon them like forceps, and they are passed from one to the other down the side of the body till they are dropped off into the water. Nothing is more curious and entertaining than to watch the neatness and accuracy with which this process is performed.

Fig. 81.

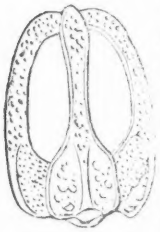
One may see the rejected bits of food passing rapidly along the lines upon which these pedicellariæ occur in greatest number, as if they were so many little roads for the conveying away of the refuse matter; nor do the forks cease from their labor till the surface of the animal is completely clean and free from any foreign substance. Were it not for the pedicellariæ the food thus rejected would become entangled among the tentacles and spines, and remain stranded there till the motion of the the water washed it away. These curious little organs have other offices besides this very laudable and useful one of scavenger. They occur over the whole body, while they pass the excrements only along certain given lines. They are especially numerous about the mouth where they are much shorter (Fig. 79) and more compact; the muscular sheath below the head is quite short, the tripartite head resting directly upon the limestone rod of the base.

Fig. 82.

Fig. 83.

On watching the movements of the pedicellariæ we find that they are extremely active, opening and shutting their forks unceasingly, reaching forward in every possible direction, the flexibility of the sheath enabling them to sweep in all the corners and recesses between the spines, and occasionally they are rewarded by catching hold of some unfortunate little crustacean, worm or mollusk which has become entangled among the spines. They do not seem to pass their prey to the mouth (at least I have never succeeded in seeing sea-urchins pass the food thus caught), but merely throw it off from the surface like any other refuse matter. Their mode of eating, also, a sort of browsing, by means of their sharp teeth along the surface of the rocks, does not favor the idea of using the pedicellariæ as forks.

Fig. 84.



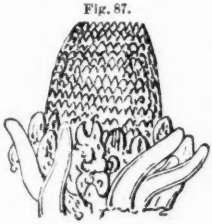
Among the different kinds of sea-urchins we find a great many modifications of the pedicellariæ just described. In the genus Cidaris the muscular sheath below the head is short and slender (Fig. 82); it is placed upon the summit of a limestone rod made up of bundles of longitudinal rods. In some Spatangoids the

separate prongs are toothed and ornamented (Fig. 83, *Brissus*). We frequently find, both in the common spherical Echini and in the Spatangoids, the forks forming either open arches, as in Fig. 84, *Echinocardium*, or very complicated ball and socket joints, or independent hemispheres with sharp grooved edges (Fig. 85, *Pourtalesia*). In our flat cake urchin (*Echnarachnius*) the more common pedicellariæ have but two forks, with sharp teeth along the edges (Fig. 86).

Fig. 85.

Fig. 86.

Fig. 87.



In the greater number of starfishes the pedicellariæ are supported upon comparatively short stems, and are as in our common starfish (*Asteracanthion*) clustered round the base of the spines of the dorsal surface (Fig. 87); though in starfishes we also find tripartite pedicellariæ as in sea-urchins, only they are usually supported upon a very short stem, or articulate directly from the limestone network of the shell. We find similarly in Echini pedicellariæ placed in pits (*Goniocidaris*) in which the stem is reduced to a minimum, and their function is quite problematical; their movements are reduced to the mere opening and shutting of the valves. It is from the study of the pedicellariæ of starfishes that we have been able to form some accurate idea of the homologies of these interesting appendages.

Fig. 88.

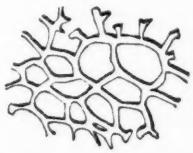
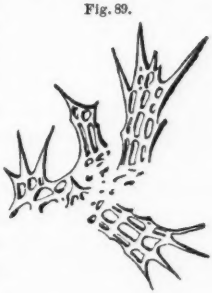


Fig. 89.



We must now go back to the early history of the growth of spines in embryo Echinoderms to obtain the key of the homologies of pedicellariæ. In all young echinoderms the test, *i.e.* the

upper coating of the arms of a starfish, the envelope of a Holothurian, the shell of a sea-urchin, is made up of an irregular network of limestone cells (Fig. 88); with increasing size this network becomes closed at certain points and sends off upright shanks which little by little form very irregular fan-shaped spines (Figs. 89 and 90); in our common sea-urchins these spines are immovable, forming at that stage part of the test itself. As the spines grow they become more pointed (Fig. 91) but are still immovable. In somewhat more advanced stages a slight constriction is formed at the base of the spine (Fig. 92) and very soon after that, below the constriction a tubercle is formed upon which the spine is articulated and capable of a certain amount of motion by means of the muscular sheath connecting the base of the spine and the tubercle, which fit by a ball and socket joint (Fig. 93); soon the spine appears longitudinally striated, the limestone cells of which it was composed when smaller being obliterated by the successive circular layers of the older spine (Fig. 94).

Fig. 90.

Fig. 91.

Fig. 92.

Fig. 94.

In some sea-urchins (*Arbacia*) we find spines which never become articulated, are always fixed, and remind us of the embryonic stage of the spines of our common sea-urchin. In one of the Echini discovered by M. Pourtalès the fixed spines cover the whole upper part of the test (Fig. 95), the movable spines being limited to a circumscribed area along the edge of the shell (Podocidaris).

Fig. 93.

Fig. 95.

If we trace the development of the spines of starfishes, we find something similar; but as the pedicellariæ are clustered round the base of the longer spines, we are able to distinguish in the earliest stages what will become a spine, and what will eventually form pedicellariæ, a distinction which it is not possible to make in Echini where the pedicellariæ and spines are irregularly

scattered. This is especially the case in such genera as Arbacia and the like, in which there are so-called embryonal spines remaining always fixed immovably to the test.

Fig. 96.

Fig. 97.

In our common starfish I have traced the earliest stages of the spines and pedicellariæ (Fig. 96), and have found that at first it is impossible to distinguish between a spine and pedicellariæ; it is only in somewhat later stages that the first trace of a difference can be detected (Figure 97); subsequently there is no doubt whatever, owing to the greater and more rapid development of the central spine, as to what will form spines or pedicellariæ (Figure 98). In one of the pentagonal starfishes of our coast (*Hippasteria*) it is even easier to trace the gradual passage of the original limestone network either, on the one hand, into a spine, or, on the other, into bipartite pedicellariæ.

Fig. 98.

Fig. 99.

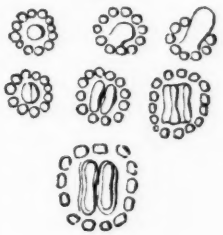
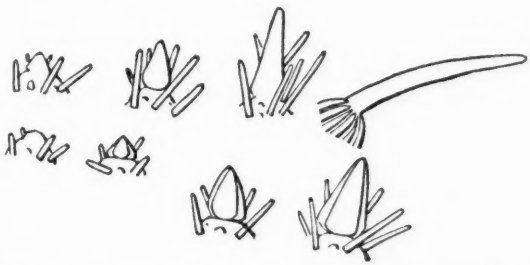


Fig. 100.

Fig. 101.



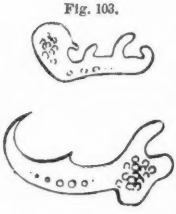
In Fig. 99 we can easily trace the development of a simple central granule, surrounded by smaller granules, into a short spine, or by the splitting of the granule we have gradually formed a slight furrow, then a deeper groove, till two clappers are formed

(Fig. 100) which eventually become movable and act as pedicellariæ, though they are the simplest forms of that organ. In another starfish, the genus Luidia, the central granule surrounded by smaller granules develops either into a spine which passes through the stages of Fig. 101, and terminates in a long slender spine surrounded by papillæ at its base, or the central spine of Fig. 101 is like the central granule of Hippasteria, little by little split into three, and forms finally a passage through such forms as are given in Fig. 101 into short tripartite pedicellariæ surrounded by isolated spines at the base. If anything further were required to prove the homology between spines and pedicellariæ it is the case of tripartite, pedunculated Echini pedicellariæ attached, as common spines are, upon a tubercle (Fig. 93) surrounded by the peculiar smooth area called the scrobicular circle; and this last form of pedicellariæ is actually found in the genus Podocidaris (Fig. 102). The same reasoning will readily suggest to the student of Echinoderms the homology of the so-called claws of Ophiurans (Fig. 103) and of the anchors of Holothurians (Fig. 104) which, although used for such totally different functions, being a sort of prehensile organ, for motion along the ground, are in reality only in their turn modified spines, or different forms of pedicellariæ.

Fig. 102.

Fig. 104.

Fig. 103.



Although the spine (Fig. 94) of our common sea-urchin is apparently so different from the pedicellariæ figured in this article, yet when we pass in review the whole order of Echini we find differences among the spines fully as great as those observed in the pedicellariæ. What can be more diverse than the immense, slender, hollow spine of a Diadema six to eight times the diameter of the test, and the short, flattened spine forming a regular pavement on the test of Colobocentrotus. We find such extremes as the club-shaped, curved, ambulacral spines of Salenia, the papillæ of Cidaris, the sharp, solid, curved, antennæ-like spines

of Coelopleurus, the massive, bat-shaped spines of Heterocentrotus, the cupuli-form spines of Goniocidaris, the slender, silk-like spines of the Clypeastroids. Among the Spatangoids, there are several families where the spines are specialized along certain lines (the so-called fascioles) in which they so retain their embryonic features, being either articulated (Fig. 105) or directly attached to the test, and provided at the extremity and along the shaft with a more or less sensitive vibratile membrane, as all young spines originally are.

In Ophiurans we find all the intermediate stages between plates, claws and slender spines; in starfishes between the simplest granules, the most complicated serrated spines and pedicellariæ, and in Holothurians, between mere spicules, anchors and the pavement-like covering of such genera as Cuvieria and Psolus. All this shows plainly enough that the spines and pedicellariæ are strictly homologous, whatever modifications they may assume in the different orders of Echinoderms, whether they serve as prehensile scavengers or simply protect the test against the violence of the waves on the rocks, or the attacks of their enemies. Sea-urchins are favorite food of many species of fish who would find it rather dangerous to attack the bristling Diademas and require pretty strong jaws to get the better of the armored Heterocentrotus. The spines are not simply organs of defence; they also act as means of locomotion, and in such genera as Arbacia the ambulacral suckers perform only a secondary part in the displacement of the sea-urchin, the spines of the lower side serving as stilts by which the sea-urchin raises itself and moves along by a kind of halting gait. In Ophiurans and Holothurians, the pedicellariæ hooks and anchors perform the part of organs of prehension and locomotion at the same time.

Fig. 105.

There is nothing in the history of the development and in the homologies of these organs to show that they have been suddenly brought into existence; on the contrary, the modifications of the spines and pedicellariæ as they have been rapidly sketched in this article show the most complete homology between appendages which have lately been considered as strong proofs of the possibility of the sudden appearance of organs for which no utilitarian motive could be given. I trust I have made it sufficiently plain

that in the most complicated pedicellariæ known, with a freely movable stalk and with snapping jaws, we have only a very gradual modification of the simplest sort of limestone network found in all Echinoderms in the earliest stages of the embryonic development, while still in the Pluteus-stage, and that we have an unbroken sequence from this primitive network to form, on the one side the most diversified spines, and on the other equally variable pedicellariæ, and that we must consider the latter in their most complicated forms as nothing but highly specialized spines.

REVIEWS AND BOOK NOTICES.

THE DEPTHS OF THE SEA.* — One could not but form a favorable impression of this sumptuously printed book from its attractive exterior; the pleasant impression is deepened by a perusal of it. The narrative is on the whole clear and graceful: the novelty of the facts and the fine illustrations will interest the lay reader, and the scientist will find placed before him in an accessible form the results obtained by the British explorations by means of the dredge and thermometer in the depths of the eastern north Atlantic and the Mediterranean Sea.

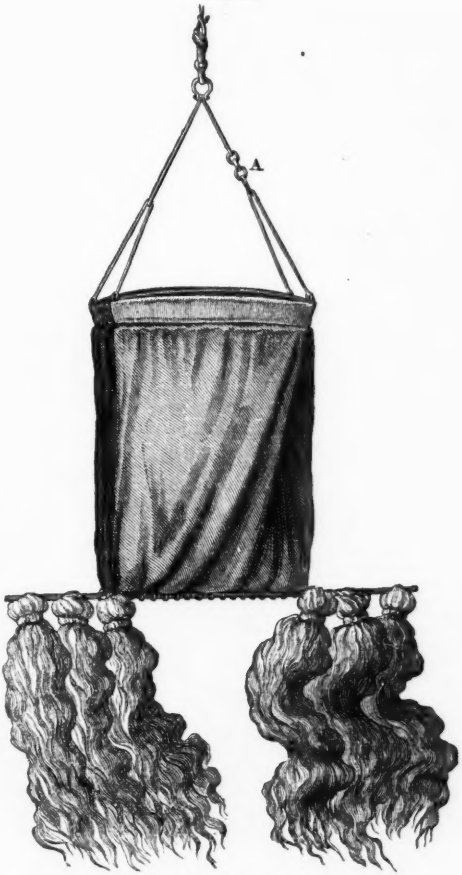
The marine zoologist will be led after reading it, as perhaps not before, to study more carefully the temperature and chemistry of the water in which he dredges, while the broader questions of the geological and geographical distribution of animals will engage his attention perhaps the more after reading Prof. Thompson's interesting summary of the joint work done by Carpenter, the physiologist and physicist; Jeffreys, the conchologist; and Wyville Thompson, the accomplished zoologist. After the introduction, we have chapters giving an account of the cruise of the "Lightning," those of the "Porcupine;" chapters on deep-sea sounding, and deep-sea dredging, on deep-sea temperatures, the Gulf Stream, the deep-sea fauna, and the continuity of the chalk.

In the introduction (p. 44) the idea is presented that deep-sea

* The Depths of the Sea. An Account of the general results of the Dredging Cruises of H. M. S.S. "Porcupine" and "Lightning" during the summers of 1868, 1869, and 1870, under the scientific direction of Dr. Carpenter, J. Gwyn Jeffreys and Dr. Wyville Thompson. By C. Wyville Thompson. With numerous illustrations and maps. New York and London, Macmillan & Co., 1873. 8vo. pp. 527. (The illustrations are in part here reproduced, thanks to Messrs. Macmillan, the publishers.)

forms dredged around the coast of Great Britain, far from being "boreal outliers," as Forbes designated them, "are the inhabitants of an enormously extended zone of special thermal condi-

Fig. 106.

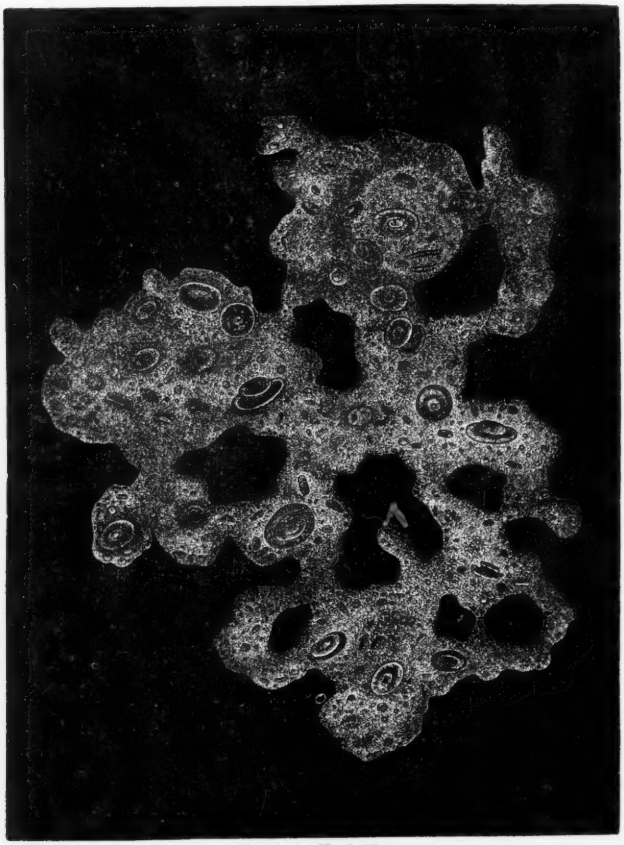


Dredge with Tangles attached.

tions, which 'crops out' as it were, or rather comes within range of the ordinary means of observation, off the coast of Scandinavia."

We are not so sure but that Forbes' notion was in the main the more correct one. Certainly from the facts presented in this book, we should gather the impression that the circumpolar fauna tended

Fig. 107.

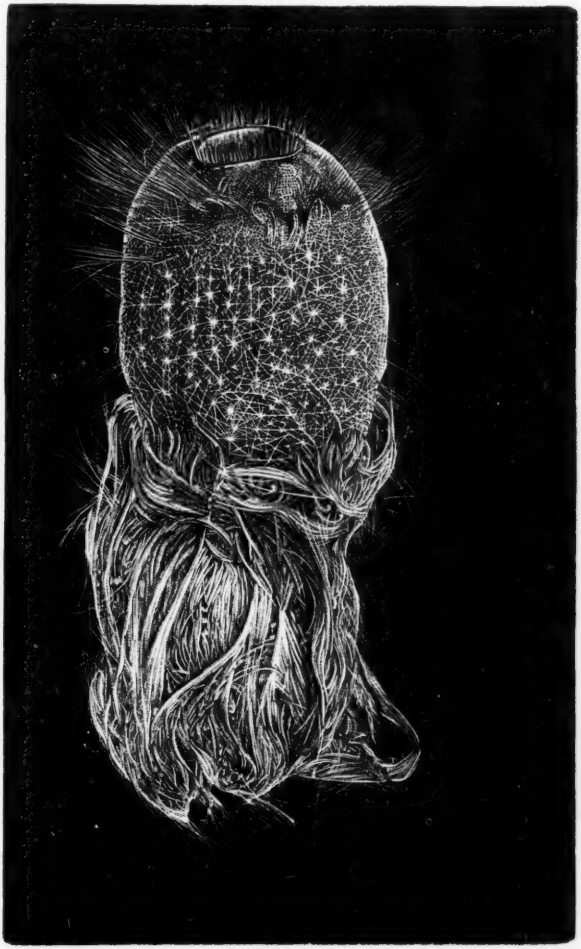


Bathybius Hæckelii.

to fade out, even at great depths off the mouth of the Mediterranean Sea; and the few arctic forms dredged off Florida by Pourtalès are mingled at great depths with a much greater abundance of tropical invertebrate life. But the facts brought out by Pour-

tales in 1867 and '68 are ignored by Professor Thompson, as we shall see farther on.

Fig. 108.



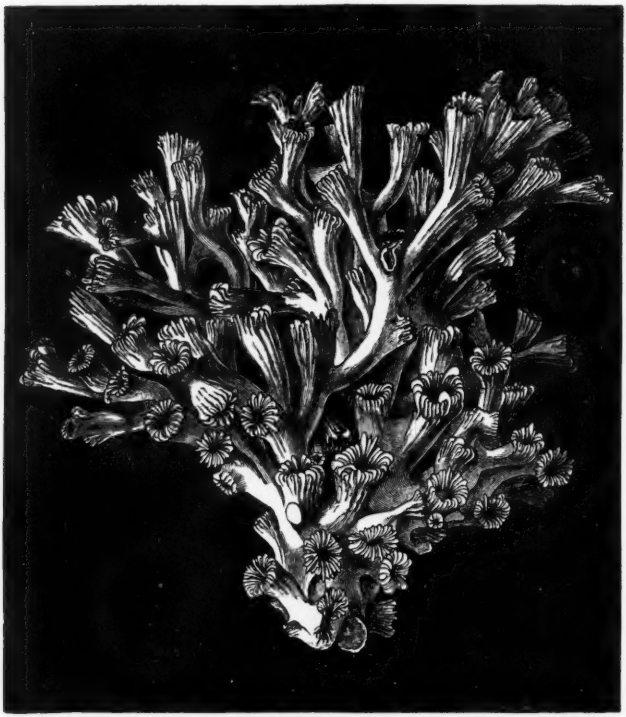
Holtenia Carpenteri.

The idea once so prevalent that animals could not exist at great depths, on account of the supposed great pressure of the sea,

is effectually disposed of by the remark that "the organism is supported through all its tissues on all sides, within and without, by incompressible fluids at the same pressure."

The chapter on deep-sea soundings is full in its details and illustrations, and it is concluded from what has been accomplished

Fig. 109.



Lophohelia prolifera.

by American and English naval officers, that "the central and southern parts of the Atlantic appear to be an old depression, probably, at all events coeval with the the deposition of the jurassic formations of Europe, and throughout these long ages the tendency of that great body of water has no doubt been to ameliorate the outlines, softening down asperities by the disintegrating

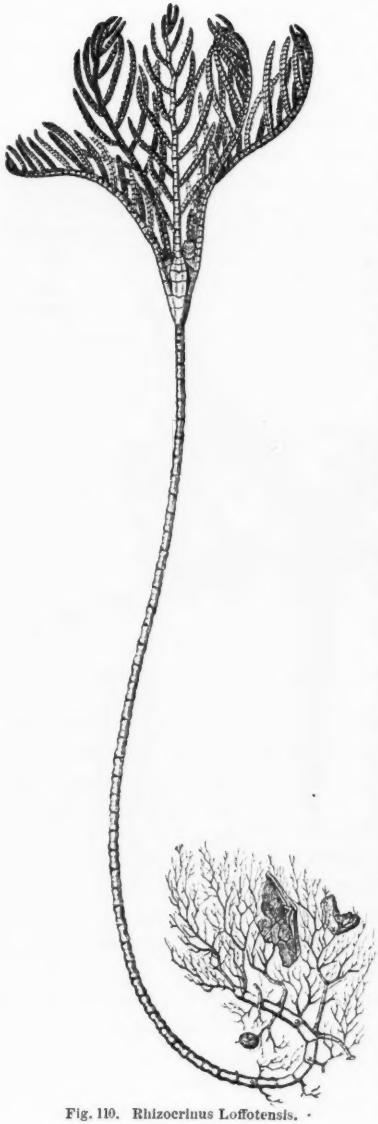


Fig. 110. Rhizocrinus Loffotensis.

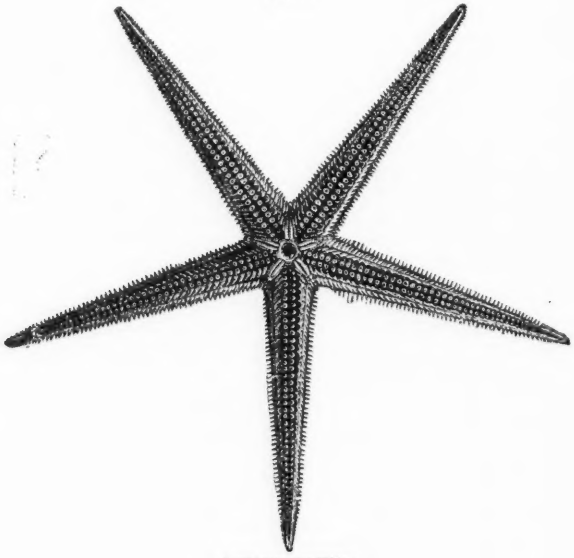
action of its waves and currents, and filling up hollows by drifting about and distributing their materials. . . . . We must regard the Atlantic Ocean as covering a vast region of wide shallow valleys and undulating plains, with a few groups of volcanic mountains, insignificant both in height and extent, when we consider the enormous area of the ocean bed."

The chapter on deep-sea dredging will be found useful and suggestive. We regret to see, however, that in the historical sketch of deep-sea dredging, what had been done previous to British explorations, by Pourtalès under the auspices of the United States Coast Survey is not fully stated. On page 231 of the fifth chapter it is remarked that "dredging operations have been conducted most successfully under Count Pourtalès, and it will be seen hereafter that his results are a valuable complement and corroboration of our own." And on page 277 it is said, "In the year 1868 Count L. F. de Pourtalès, one of the officers employed in the

United States Coast Survey under Professor Pierce, commenced a series of deep dredgings across the gulf stream off the coast of Florida, which were continued in the following year, and were productive of most valuable results."

On turning, however, to the sixth "Bulletin of the Museum of Comparative Zoology," published at Cambridge, Mass., Dec. 26, 1867, we learn that from dredgings off the coast of Florida between May 17th and 29th, and carried to the depth of three hundred and fifty fathoms, Pourtalès concludes that "short as the

Fig. 111.



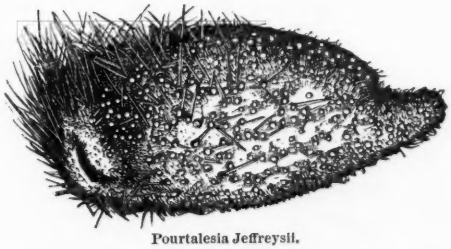
Archaster vexillifer.

season's work was, and few as were the casts of the dredge, the highly interesting fact was disclosed, that *animal life exists at great depths, in as great a diversity and as great an abundance as in shallow water*" (the italics are his).

The work in the spring of 1868 was carried on at a maximum depth of five hundred and seventeen fathoms: thus two seasons' work was accomplished by the United States Coast Survey before the British Steamer "Lightning" weighed anchor at Oban the 8th of August, 1868, for the first British deep-sea dredging voyage.

To the Scandinavian naturalists (particularly Professor M. Sars and his son G. O. Sars beginning with 1850) however, we owe the impetus, which led American and English naturalists to dredge at great depths. Prof. Lovén, however, in 1863, referring to the result of the Swedish Spitzbergen expedition of 1861, when mollusca, crustacea and hydrozoa were brought up from a depth of fourteen hundred fathoms, expresses the remarkable opinion which later investigations appear generally to support, that at great depths, wherever the bottom is suitable, "a fauna of the same general character extends from pole to pole through all degrees of latitude, some of the species of the fauna being very widely distributed." We reproduce (thanks to the publishers) a figure (106) of the dredge with hempen tangles attached, a most valuable

Fig. 112.



Pourtalesia Jeffreysii.

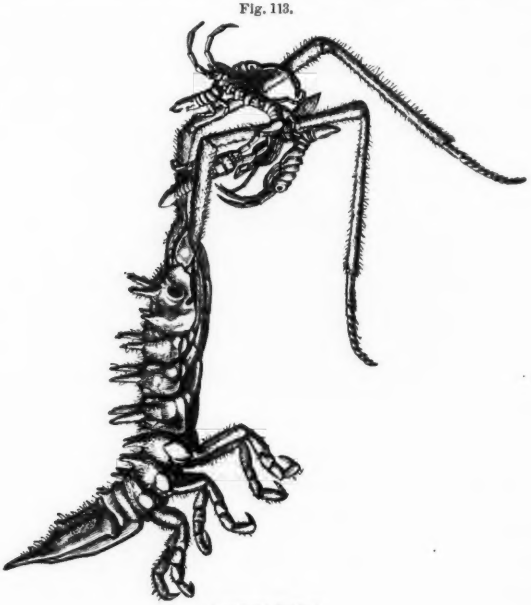
means of fishing up animals such as starfishes, echini and sponges, which the dredge fails to obtain entire or in sufficient numbers.

The exceedingly interesting and able discussion of the origin and relations of the Gulf Stream we must pass over. Our author, however, dissents emphatically from the well known views of his colleague, Dr. Carpenter, on these points. In the account of the deep-sea fauna the *Bathybius Hœckelii* (Fig. 107), which created so much excitement at the time of its discovery, of course is first noticed. Thompson thus speaks of it, "If this have a claim to be recognized as a distinct living entity exhibiting its mature and final form, it must be referred to the simplest division of the shell-less Rhizopoda, or if we adopt the class proposed by Professor Hæckel, to the Monera. The circumstance which gives its special interest to Bathybius is its enormous extent; whether it be continuous in one vast sheet, or broken up into circumscribed individual particles, it appears to extend over a large part of the bed

of the ocean." Fig. 107 is a mass of the protoplasmic material of which Bathybius is formed, with Coccoliths embedded in it, magnified seven hundred diameters.

As an example of the sponges abounding at great depths is the *Holtenia Carpenteri* (Fig. 108, half the natural size). A characteristic coral is the *Lophohelia prolifera* of Pallas (Fig. 109, three-fourths the natural size), which at the depths of three hundred to

Fig. 113.



Arcturus Baffini.

six hundred fathoms "forms stony copses covering the bottom for many miles."

Among the Echinoderms, the *Rhizocrinus Loffotensis* of Sars (Fig. 110, once and a half the natural size) is interesting not only in itself, but as having been found by Pourtalès to occur in the depths of the Gulf Stream off Florida.

The starfish, Archaster, is characteristic of the abysses of the northern seas, and a fine new form is *Archaster vexillifer* W. Thomp. (Fig. 111). A most singular and intensely interesting

sea-urchin is the Pourtalèsia, first found by Pourtalès off the coast of Florida. The British dredgers have revealed a second species (*P. Jeffreysii* W. Thomp., Fig. 112, slightly enlarged). It is closely related to a cretaceous group, the Dysasteridæ. Finally, among crustacea, the sociable *Arcturus Baffini* (Fig. 113, about natural size) with its young clinging to its antennæ is worthy of note as an arctic form.

Many interesting mollusca were obtained, comprising a multitude of new species. Some dredgings in nine hundred and ninety-four fathoms off the Spanish coast revealed "a marvellous assemblage of shells, mostly dead, but comprising certain species which we had always considered as exclusively northern, and others which Mr. Jeffreys recognized as Sicilian tertiary fossils, while nearly forty per cent of the entire number of species were undescribed, and some of them represented new genera." On another occasion in seven hundred and eighteen fathoms off Spain the *Verticordia acutilostata* was taken. This shell "is fossil in the coralline crag, and the Sicilian pliocene beds, and it now lives in the Japanese archipelago."

In the final chapter the doctrine of the continuity of the chalk period with the present is discussed: in other words "that in the deeper parts of the Atlantic a deposit, differing possibly from time to time in composition but always of the same general character, might have been accumulating continuously from the cretaceous or even earlier periods to the present day."

The "Depths of the Sea" is a work that every biologist should read, and for the general student of science it is the only general treatise on this subject. We hope so pleasant and thoroughly educated a narrator as Professor Thompson will be able to favor us with a similar work on the subject, at the close of his "Challenger" cruise. Certainly he will be in a position, if ordinary success attends this important expedition, to give to the world, in connection with American and German observations, results still more comprehensive and conclusive than those flowing from the cruises of the "Lightning" and "Porcupine."

COLOR-VARIATION IN BIRDS DEPENDENT UPON CLIMATIC INFLUENCES.*—The critic's office is not seldom ungracious, and we have

*On the relation between Color and Geographical Distribution in Birds, as exhibited in Melanism and Hyperchromism [*lege* Hyperchromatism]. By Robert Ridgway. Am. Jour. Sci., 3d ser., iv, Dec., 1872, p. 454; v, Jan., 1873, p. 39.

never felt it to be more so than in the present instance; but, having undertaken to keep the readers of the NATURALIST *au courant* with the progress of American ornithology, we shall not shrink from any responsibility this may involve. We recognize Mr. Ridgway's paper as highly meritorious, and a valuable contribution to philosophic ornithology; it is good strong work in a comparatively new field. But until the truths it elucidates are generally recognized and become the common property of ornithologists, it will remain eminently proper to handle the subject not exactly after Mr. Ridgway's method; for he writes as if his views were both novel and original, which is not the case. To speak plainly, the paper is based entirely upon Mr. Allen's views, without the slightest allusion to this author; and is illustrated chiefly by cases already published, yet without the proper references. This is of no consequence to science, in the abstract, and does not detract from the scientific merit of the paper, which lies in its pointed and forcible illustration of certain laws; but in science, much as elsewhere, individual rights must be respected — *noblesse oblige*. In raising an ethical question by our articles of impeachment, we will put the charge of appropriating Mr. Allen's work without acknowledgment into this shape: — *a*, either Mr. Ridgway's views, here enunciated, are original, or, *b*, they are not. If *a*, we acquit him of scientific plagiarism, and accredit him with discovery, but accuse him of suppressing the fact, known to him, that the same discoveries had been already made by another person, and published about eighteen months previously. If *b*, the case speaks for itself too plainly to require further remarks. Mr. Ridgway has been for so long a time an industrious and painstaking student of ornithology that the facts he here elucidates cannot well have escaped his own investigations; and the feeling that he fairly earned his results may have led him to disregard the simple fact that he was anticipated in publication. Without further personal remarks we shall quote the record * in substantiation of what we say; and if we are unjust, or even incorrect in any particular, the pages of the NATURALIST are, of course, open to a refutation of our statements.

The point of Mr. Ridgway's paper is this: a melanistic ten-

*ALLEN, Bull. Mus. Comp. Zool., ii, 1871, No. 3, pp. 229-249. ID., *op. cit.*, iii, July, 1872, *passim*.—COUES, Proc. Phila. Acad., July, 1872, 60.— ID., Key N. A. Birds, Oct., 1872, *passim*.

dency, and a greater brightness, or increased prevalence, of the three primary colors, red, blue, and yellow, "are mainly noticeable as the result of a tropical influence, for they are most highly developed in middle America, and become exaggerated in proportion to the decrease of latitude. But in the Pacific province of North America they are, in many cases, either entirely similar or represented by somewhat modified analogous laws"* (p. 454).

The leading illustration of the *melanistic* tendency selected is the remarkable case of *Chrysomitris psaltria* and its races; this we first worked out in 1866 (Proc. Phila. Acad., 81), exactly as it is here presented, although *C. psaltria* was not then formally brought into the connection, as it has since been by us (Key, Oct., 1872, 132, 133). Mr. Ridgway's next melanistic case is that of *Myiarchus Lawrencii*, of which he has two varieties, the middle American var. *nigricapillus*, and the South American var. *nigriceps*.† Among other similar cases, he cites *Picus villosus* var. *Harrisii; P. pubescens* var. *Gairdneri;* and *Sphyrapicus varius* var. *ruber;* the implication being, that such nomenclature, and the views sustaining it, are novel.‡

The first case cited under the law affecting primary colors with "hyperchromism," is that of the *Xanthoura*, § illustrating changes in *yellow*. The next is that of *Myiodioctes pusillus* var. *pileolata* RIDGW.‖ The case of the genus *Geothlypis* is, however, chiefly employed in this illustration, and a number of interesting relationships, entirely novel, are brought out. The writer is only forestalled here in one instance.¶ In handling the variations in *red*,

*"The increase in color to the southward, especially the tendency to darker tints above shown to be so general. . . . . The southward increase in depth of color, and in iridescence, in birds specifically identical, coincides, also, with the general increase in brilliancy of color, . . . the maximum being reached in the tropics. . . . .

The longitudinal variation, or the westward increase in color, seems to be, also, coincident with the increased humidity to the westward." (ALLEN, 1871, 239.)

"Intensity of coloration varies in direct ratio with the temperature and humidity of the breeding-place." (COUES, Proc. Phila. Acad., July 2, 1872, 60.)

†"*M. nigricapillus* is simply a slight tendency toward *nigriceps*."—COUES, Proc. Phila. Acad., July, 1872, 75.—"Having no doubt that *nigriceps* is simply a geographical representative of *Lawrencii*," etc.—COUES, *ibid.*, 76.

‡*Picus villosus* var. *Harrisii*, ALLEN, Bull. M. C. Z. iii. July, 1872, 180; discussed on p. 114.—COUES, Key, 194.—*P. pubescens* var. *Gairdneri*, COUES, Key, 194.—Under head of *S. ruber*, it is said in the "Key," p. 195:—"Size of the last [*S. varius*]. . . . . of which it is apparently only a variety."

§ Compare *X. Yncas* var. *luxuosa*, COUES, Key, 166.

‖ From the *Muscicapa pileolata* of PALLAS, Zool. R.-A.—Compare BAIRD, Birds N. A., 1858, 293, in text.

¶ *Geothlypis Philadelphia* var. *Macgillivrayi*, ALLEN, Bull. M. C. Z. 1872, 175.

the author employs *Cardinalis*, *Carpodacus* and *Sphyrapicus;* making a new Mexican variety, *carneus*, of *Cardinalis Virginianus*, and following a previous writer * in reducing *C. igneus* of Baird to a variety. In the matter of *blue*, the *Cyanura Stelleri* series is adduced and very skilfully treated. An interesting parallelism of *Stelleri* and *coronata* is elucidated; the writer keeps the two distinct species, although he confesses that they intergrade at one point. The peculiar mode of parallelism is here presented for the first time; the rest of the case is not novel †— E. C.

Late Local Lists.—Of three papers of this sort which have reached our table, Mr. Dall's ‡ is the most important, relating to the least known locality. Some of our readers will remember that on a previous occasion we had to speak in high terms of this gentleman's and Dr. Bannister's researches, which resulted in adding many new birds to our fauna. Following up his Alaskan investigations, in connection with the U. S. Coast Survey, Mr. Dall now reports upon 53 species observed in the Aleutian Islands from Unalashka to the Shumagins. "The facts noted are an additional confirmation of the peculiarities of distribution noted by me in previous publications on the fauna of Alaska; and the region visited is of peculiar interest, as being the portion of the West coast where the arctic Canadian fauna of the region north of the Alaskan range, and the characteristic West coast fauna which prevails south of that range, come together and are to a certain extent intermingled." In addition to the names of the species forming the "face" of the report, we have many biographical notes, sometimes extensive, as in case of the kittiwake; sometimes novel, as in the instance of the beautiful Steller's eider, and always interesting. Particular attention has been given to the life-colors of the iris, a matter too often neglected by those whose

* *Cardinalis Virginianus* var. *igneus*, Coues, Key, 151. Also discussed by Allen, July, 1872, p. 114.

† "There appears to be a regular succession of jays of the present group between two extremes of color." Baird, Birds N. A., 1858, 583.—"A large series of specimens [of *C. macrolopha*], chiefly from the headwaters of the Columbia, have the front washed with dull blue, and have also the white supra-ocular spot." Coues, Proc. Phila. Acad., 1866, 93.—"Steller's and the long-crested, so much alike that they might be considered as one species; the last named runs into the *C. coronata* of Mexico." Coues, Am. Nat. v, 1871, 770.—"*Cyanura Stelleri* var. *macrolopha*."—Allen, Bull. M. C. Z. iii, 1872, 178; Coues, Key, 165, fig. 107.

‡ Notes on the Avi-fauna of the Aleutian Islands, from Unalashka Eastward. By W. H. Dall, U. S. Coast Survey. (From the Proceedings of the Californian Academy of Sciences, printed in advance, Feb. 8, 1873.)

opportunities for contributing this information are both ample and inviting. The nomenclature adopted is not a late one, and many of the species are only nominal, though the competent ornithologist will make the required changes without difficulty in most cases. We note the appearance of a certain "*Hirundo Unalashkensis?* Gmelin"— a species neither identified of late years, nor now determined by Mr. Dall. *Troglodytes Alaskensis* Bd. is properly reduced to a variety of *hyemalis* (*Cf.* Key N. A. Birds, p. 351): but *Melospiza* "insignis," which ought to be similarly treated, stands, as do *Aquila* "Canadensis," *Brachyotus* "Cassini," *Leucosticte* "griseinucha," *Passerculus* "Sandwichensis," *Corvus* "carnivorus," *Pica* "Hudsonica," and many other mere varieties or pure figments. Among interesting occurrences may be noted a second American specimen of *Limosa uropygialis*, lately added to our fauna, and *Moreca penelope*. By this and his previous paper, Mr. Dall has made himself our chief authority on the birds of our newly acquired territory.

With Mr. Allen's late "Reconnoissance," Messrs. Holden and Aiken's paper,* just out, Mr. Ridgway's, for the coming Report, the still unpublished explorations of Dr. H. C. Yarrow and Mr. C. H. Merriam, Lt. Bendire's partially elaborated operations in Arizona, and we may be permitted to add, the whole results of Dr. Hayden's investigations, now in preparation by ourselves — the birds of the interior western territories are getting such an overhauling as they have not had for the past fifteen years. The editor of the Holden–Aiken paper says, "The following interesting notes were prepared for my own private perusal, and not designed for publication. They are possessed of too much interest to be withheld, embodying as they do the careful observations of two promising young ornithologists who have explored, at different seasons of the year, a comparatively new field." The editor is thus responsible for the "get-up" of the paper; and this dovetailing the independent researches of different observers has been done in a way that reminds us of the alleged fact, that Homer nodded once. For we are left in ignorance of, or to find out if we can, the *localities* of observation. "Wyoming and Colorado Territories" cover a good deal of ground, and much of the edge is taken

*Notes on the Birds of Wyoming and Colorado Territories. By C. J. Holden, jr. With Additional Memoranda, by C. E. Aiken. Edited by T. M. Brewer. (From the Proceedings of the Boston Society of Natural History, xv, Dec., 1872, pp. 193-210.)

off the article because we cannot localize the occurrences more precisely. Mr. Holden's observations appear to have been made about Sherman, in the southeast corner of Wyoming, quite a long way from the "Black Hills" as laid down on the maps; while Mr. Aiken's (we understand) were in Colorado, somewhere about Cañon City or Fountain, south of Denver. That our criticism does not lack point may be seen in the fact, that out of 142 species reported upon, only 26 (not one-fifth) are mentioned by both observers; and nearly 100 are given by Mr. Aiken alone. This shows such a radical difference in the faunal characteristic of the regions embraced in the paper, that its two sides would have been presented much better apart; while if merged, the precise locality of observation should have been given in every instance. As it stands, such birds as *Geococcyx Californianus* and *Pipilo mesoleucus* find themselves in ornithological company they never saw outside of a book. The biographical notes are excellent and perfectly reliable. We note with surprise the breeding of *Scolecophagus ferrugineus* in a place (somewhere between the Black Hills, Wyoming and Cañon City, Colorado) where *S. cyanocephalus* would have been expected, and also the occurrence of *Erismatura Dominica* somewhere in Colorado or Wyoming. A new bird, *Junco hyemalis* var. *Aikenii*, is named, but not described, nor is even the authority for the name given. As the page stands, Mr. Aiken is placed in a peculiar predicament of having named a bird after himself. It is not to the point that we, or others, happen to know what the bird is, and who its sponsor is. The name here published for the first time, though it may have been already in type elsewhere, should have been accompanied with a description, or at least a reference. Other nomenclatural points might be criticised. Thus *Cyanura macrolopha* and *Cyanocitta Woodhousei* are certainly not good species: while the impropriety of the name "*Myiarchus Mexicanus*" for the *Tyrannula cinerascens* of Lawrence has been fully exposed by Dr. Sclater, Mr. Lawrence and ourselves.

Mr. Scott's list* "gives the results of about two months of field-work (from the middle of June till the middle of August) on the bird fauna of a portion of Kanawha County, West Virginia. Dur-

*Partial List of the Summer Birds of Kanawha County, West Virginia; with annotations. By W. D. Scott. Proceedings of the Boston Society of Natural History, xv, Oct., 1872, p. 219.

ing this time 86 species of birds were noted or taken." The writer's work was evidently thorough and searching, and the paper bears intrinsic marks of trustworthiness. We find nothing to criticise, but on the contrary would call attention to several interesting items, notably those relating to the abundance and breeding of *Seiurus Ludovicianus* in this locality, and the occurrence of *Dendræca Dominica* so far north. The author's views appear progressive, as witnessed in *Parus atricapillus* var. *Carolinensis*.—E. C.

BOTANY.

Supposed American Origin of Rubus Idæus.—Our cultivated raspberry is an importation from Europe. Our native red raspberry, *R. strigosus*, however, is so near it that the specific distinctness has been in doubt; and specimens from British America and the Rocky Mountains certainly occur which a botanist must needs refer to *R. Idæus* itself. In his studies of the European *Rubi*, Prof. Areschoug (in Botaniska Notiser, 1872, and in a translation by himself in Trimen's Journal of Botany, April, 1873, p. 108, etc.) makes prominent and important the fact that *R. Idæus* has no near relative, or in other words is the sole raspberry in Europe, but in mode of growth, in the bark, etc., as well as in the fruit, accords with American species,—with one of them so closely that all who have come to the conclusion that species have a history must needs infer a community of origin. Areschoug concludes, accordingly, that "this species did not originally have its home in Europe, but its origin is to be found in the east of Asia, viz.: Japan and the adjacent countries, or perhaps in North America." It is one of the members of that old boreal flora (as we suppose) now mainly East Asiatic and North American, which has found its way to, or held its place in, the north of Europe somewhat exceptionally. Both *R. strigosus* and *R. Idæus* inhabit Japan and Mandchuria, and Maximowicz regards them as forms of a common species. Prof. Areschoug adopts the now familiar idea "that the Asiatic and North American floras have reciprocally mixed with each other by passing Behring's Straits and the islands which in its neighborhood form a bridge between the two continents;"—which is a partial explanation of a problem that has to be treated far more generally now that we have reason to believe that this flora formerly filled the Arctic zone. He thinks, more-

over, that the simple-leaved frutescent species (also extra-European) are the ancestors of those with divided leaves,— but this is a speculation of a different character, upon which little or no evidence can be brought to bear.—A. GRAY *in American Journal of Science.*

BOTANICAL NOTELETS.— *Equisetum arvense* is characterized as having, and generally has, its branches 4-sided and the teeth four. Milde describes a variety *boreale*, chiefly high northern, with three teeth and 3-sided branchlets. This form is very common around Boston, chiefly in grassy places, and it might in the absence of the fertile plant be mistaken for *E. pratense*. It has been noticed here for some time, but attention has been called to it by Mr. Wm. Boott.

Cypripedium acaule with two flowers has been sent by Mr. J. S. Scott, of Westfield, Mass. The flowers are approximated, the second bract close to and opposite the usual one; and the lips of the two of course facing each other.

Acer nigrum with stipules, at Wabash, Indiana, which Mr. Mills brought to our notice last year, holds the character this season, not only in the tree first observed but in several others.

Anemone nemorosa, or *trifolia*. From the Peaks of Otter, at altitude of about three thousand feet, Mr. A. H. Curtiss sends an anemone of a form new to this country (although there is some approach to it in Oregon), which may be called *A. nemorosa* with undivided leaflets or *A. trifolia* L., according to the botanists' fancy. It is fully as large as the latter, having the stem a foot high up to the leaves, and the leaflets two and one-half inches long; the deepness of the teeth of these, and a slight tendency to trilobation, should rather refer it to *A. nemorosa*, which not rarely exhibits this state in Europe. This European form, as Mr. Curtiss remarks, appears to have kept company with *Convallaria majalis*, being here associated with it in one of the most northern stations of this plant, which in America is restricted to the Alleghanies.

Dimorphism in Forsythia. In Cambridge and its vicinity all the blossoms of *Forsythia suspensa* have long filaments and a short style; all those of *F. viridissima* have short filaments and a long style. This was noticed by Mr. Brown, one of my pupils, of the present Senior Class. In all probability this is not a specific difference, but one of dimorphism. That only a single form of each

species should be met with in this neighborhood, or even in the country, is not extraordinary, since these shrubs are propagated from cuttings or slips. The published figures of *F. viridissima* are of the long-stamened sort. Siebold and Zuccarini describe the long-styled form of *F. suspensa*, the counterpart of the one we have, but their plate represents both; so that the fact of dimorphism is pretty well made out.—A. GRAY.

ZOOLOGY.

THE DIMINUTION OF FOOD FISHES.—In our recent abstract of the annual report of the Commissioners of Fisheries of this State, reference was made to a letter addressed to the Commissioners by Prof. Baird of the Smithsonian Institution and United States Commissioner of Fish and Fisheries, in answer to one sent by them asking his opinion as to the probable cause of the rapid diminution of the supply of good fishes on the coast of New England, and especially of Maine. The letter is of such an interesting character that we subjoin it nearly entire: —

"We are all very well aware," writes Prof. Baird, "that fifty or more years ago, the streams and rivers of New England, emptying into the ocean, were crowded and almost blockaded, at certain seasons, by the numbers of shad, salmon and alewives seeking to ascend for the purpose of depositing their spawn, and that, even after these parent fish had returned to the ocean, their progeny swarmed to an almost inconceivable extent in the same localities, and later in the year descended to the sea in immense schools. It was during this period that the deep-sea fisheries of the coast were also of great extent and value. Cod, haddock, halibut, and the line fish generally, occupied the fishing grounds close to the shore, and could be caught from small open boats, ample fares being readily taken within a short distance of the fishermen's abode, without the necessity of resorting to distant seas. Now, however, the state of things is entirely different. The erection of impassable dams upon the waters of the New England States, and especially of the State of Maine, has prevented the upward course of the anadromous fishes referred to, and their numbers have dwindled away, until at present they are almost unknown in many otherwise most favorable localities.

The fact, too, has been observed, that with the decrease of these fish there has been a corresponding diminution in the numbers of the cod and other deep-sea species near our coasts; but it was not until quite recently that the relationships between the two series

of phenomena were appreciated as those of cause and effect. Halibut, it is believed, can be reduced in abundance by over-fishing with the hook and line, but the experiences in Europe and America coincide in the confirmation of the opinion that none of the methods now in vogue for the capture of fish of the cod family (including the cod, haddock, pollock, hake, ling, etc.) can seriously affect their numbers. Fish, the females of which deposit from one to two million of eggs every year, are not easily exterminated unless they are interfered with during the spawning season, and as this takes place in the winter and in the open sea (the spawn floating near the surface of the water), there is no possibility of any human interference with the process. Still, however, these fish have become comparatively very scarce on our coast, so that our people are forced to resort to far distant regions to obtain the supply which formerly could be secured almost within sight of their homes.

It is now a well established fact that the movements of the fishes of the cod family are determined; first, by the search after suitable places for the deposit of their eggs; second, by their quest of food. Thus the cod, as a summer fish, is comparatively little known on the coasts of northern Europe; but as winter approaches the schools begin to make their appearance on the northwestern coast of Norway, especially around the Loffoden islands, arriving there finally in so great numbers that the fishermen are said to determine their presence by feeling the sounding lead strike on the backs of the fish!

Here they spend several months in the process of reproduction, the eggs being deposited in January and the fishery being prosecuted at the same time. Twenty-five to thirty thousand men are employed in this business for several months, at the end of which the fish disappear and the fishermen return to their alternate occupations as farmers and mechanics. The fish are supposed to move off in a body to the Grand Banks, which they reach in early summer, and where they fatten up and feed until it is time for them to return again to the northeast. It is believed that the great attraction to the cod on the Banks consists in part of the immense schools of herring or other wandering fish, that come in from the region of the Labrador and Newfoundland seas, and which they frequently follow close in to the shore, so that they are easily captured.

It is well known that the presence or absence of herring determines the abundance of hake and cod on the Grand Manan Fishing Banks, the fishes of the first mentioned family having a peculiar attraction to carnivorous fish of all kinds. It is, however, the anadromous fishes of the coast which bring the cod and other fishes of that family close in upon our shores. The sea herring is but little known outside of the region of the Bay of Fundy, excepting in September and October, and when they visit the entire

coast from Grand Manan to Scituate, for the purpose of depositing their spawn; this act depending upon their finding water sufficiently cold for their purposes, a condition which of course occurs later and later in the season, in going south. A portion of the school indeed passes around Cape Cod as far as Long Island, and I have received them fresh in November, filled with ripe spawn as taken from Vineyard Sound.

In the early spring the alewives formerly made their appearance on the coast, crowding along our shores and ascended our rivers in order to deposit their spawn, being followed later in the season by the shad and salmon. Returning when their eggs were laid, these fish spent the summer along the coast; and in the course of a few months were joined by their young, which formed immense schools in every direction, extending outward in some instances for many miles. It was in pursuit of these and other summer fish that the cod, and other species referred to, came close to the shores; but with the decrease of the former in number, the attraction became less and less, and the deep-sea fishes have now, we may say, almost disappeared along the coast.

It is, therefore, perfectly safe to assume that the improvement of the line fishing along the coast of Maine is closely connected with the increase in number of alewives, shad and salmon: and that, whatever measures are taken to facilitate the restoration of these last mentioned fish to their pristine abundance, will act in an equal ratio upon the first mentioned interest. The most important of the steps in question are the proper protection of these spring fish, and the giving to them every facility needed for passing up the streams to their original spawning grounds: this is to be done, of course, by the construction of suitable fishways and ladders. The real question at issue in regard to the construction of these fishways is, therefore, after all, not whether salmon shall become more plentiful, so that the sportsmen can capture them with the fly, or the man of means be able to procure a coveted delicacy in large quantities and at moderate expense. This is simply an incident; the more important consideration is, really, whether the alewife and shad shall be made as abundant as before, and whether the cod or other equally desirable sea-fish shall be brought back to our coast, so that any one who may be so inclined, can readily capture several hundred weight in a day.

The value of the alewife is not fully appreciated in our country. It is in many respects superior to the sea herring as an article of food; is, if anything, more valuable for export, and can be captured with vastly less trouble, and under circumstances and at a season much more convenient for most persons engaged in the fisheries.—*Boston Daily Journal.*

The Young Animal and Protection. — In the Naturalist for August last, Mr. Deering advances the well known fact that

the young rattlesnake is not provided with so large or so loud a rattle as the full grown snake, as tending to disprove the mimetic and protective uses of this appendage—"The young requiring greater facilities for obtaining food, and more extensive measures for protection."

Were this accepted as satisfactory reasoning, a similar conclusion might be reached in regard to a multitude of animals, for instance, all those having horns, as the deer, goat, antelope, etc., in which the young are unarmed: yet the protective uses of the horns cannot be questioned. With many of those animals, the female is invariably destitute of these appendages, yet we might suppose, from her position as the immediate protector of her offspring, that she required to be most fully provided in this respect.

The truth is that, to a remarkable extent, the young of most creatures are little else than the food of other animals; often they are the food of even their own species, if not of their own parents. Nothing is more emphatically proclaimed, on every side, than the fact (put into such divine language by Tennyson) that Nature is careless of the individual, however careful she may be of the type. She forms a thousand seeds, but only one germinates and produces its kind. We have, too, the mystery of the pollen, which I have watched for years with wonder, where, in one case, with apparently miserly penuriousness, she doles out the precious life-giving atom just sufficient to fecundate, while, in other instances, as if glorying in her prodigality, she scatters the golden dust as freely as some spendthrift heir squanders the hoarded wealth of his ancestors.

Yet I have perfect faith that "nothing is lost" — nothing wasted; but that all has a governing purpose, circumscribing to the very nicest minutiæ the exact proportion requisite for the result; albeit hidden from our purblind eyes. We know so many of Nature's delicate adjustments and wonderful combinations that, surely, we can have perfect confidence that, even when all is dark to us, her ways are Wisdom's ways. We bring out our clumsy balances, but the volatile aroma escapes us and will not be weighed.

As to the frequency of the young animal not being provided with the protective weapons or appliances of the full grown one, abundant material can be found, from the oyster and lobster, the young

of which are notoriously exposed to destruction, to the noble stag attired with his "branchy crown," rejoicing naturally in his so thoroughly personified gender, guarding the herd of which he is the monarch, or the slow, sullen buffalo, where we see the males forming an impassable cordon around the mother cows and their helpless calves, when assailed by the "cruel archers," the bulls bearing behind their horns the calves when wounded, to a place of safety.

Why the young are unprovided with horns, or even the power to use them, is part of the great plan; and doubtless, may well be considered as tending to prove that at the first, the animal was not so protected, but slowly acquired these weapons through development. The early condition of the horns of the deer covered with smooth velvet, and unsuitable for defence, is another point favoring this view, which is strongly supported by a large amount of corroborative testimony in other animals.

Numberless facts offer themselves on this subject — the protection of the young, and its kindred subject — the precautions adopted to ensure fertilization. The suddenly acquired fierceness of the parent when guarding its offspring is a remarkable episode in the lives of many of the lower animals. This passion, frequently carried to the extreme of rendering them temporarily regardless of personal danger when even their lives are threatened, can only be recognized with wondering admiration;— too often, indeed, it puts our boasted human nature to the blush. This, after all, must be considered as the chief means of protection for the young animal. Though, it cannot be denied, instances are far from infrequent where the parent has the proclivity to devour its offspring.

Among insects the parental instinct is often wonderful, prompting them, not only to defend their young when attacked, but leading them, even in those cases where the parent's life expires previous to the full development of the progeny, to provide for its future, surrounding it with a network of protections, and circumstances adapted to its well-being. — HENRY GILLMAN.

THE WHITE-FRONTED OWL IN CANADA.— Although the "white-fronted owl" (*Nyctale albifrons* Cass.) is now conceded by most if not all American ornithologists to be the young of the saw-whet (*Nyctale Acadica* Bon.), its supposed rarity in comparison with the

adult renders the following record of recent instances of its capture in Canada of considerable interest. Mr. Ridgway, in a paper published in this journal in May, 1872, in noticing Mr. D. G. Elliott's mistake of considering the *N. albifrons* to be the young of *N. Tengmalmi*, has carefully elaborated the evidence of its being the young of *N. Acadica*. This relationship had been previously suspected, and seems now to be fully confirmed. Mr. McIlwraith, under date of Hamilton, Ontario, Canada, Jan. 20, 1873, writes as follows: "On looking over the NATURALIST of April, 1871, I observe a notice of the capture of a specimen of the white-fronted owl in Maine, and the writer of the note, Prof. A. E. Verrill, says that the only other instance of its occurrence in the United States of which he is aware, is the specimen taken by Dr. Hoy at Racine. I am a little surprised at this, for, though not coming much in contact with collectors, I have seen or heard of this species now and then for a number of years back. My first knowledge of it was from Cassin's account, and the figure given of it, in his Birds of America. Shortly afterwards I recognized it in a small case in the possession of the Rev. Professor Ingles, now of the Dutch Reformed Church, Brooklyn, New York, where it was labelled "Saw-whet-Young." The case was brought from Montreal. I next met with it in Toronto, where Mr. Passmore, taxidermist, had two specimens, one of which I obtained and have now in my collection. Again I heard from Mr. P. H. Gibbs, of Guelph, that there were several about his evergreens near the house, one of which he shot. About the same time Mr. Booth, a naturalist of Drummondville, told me of a specimen he had obtained. Dr. Anderson, of Point Levi, opposite Quebec, had his alive for a time, and I heard of still another in the hands of R. K. Winslow, Esq., of Cleveland, Ohio. From the foregoing it would seem to be more common in Canada than it is farther south. The opinion seems to be generally held by those parties with whom I have conversed on the subject that it is the young of the saw-whet, and yet it is somewhat singular that it is not as often met with as its supposed parents. In the month of October, a few years since, I had six in the saw-whet form brought me by a lad who got them all near the same place on his father's farm; yet not one of the other was met with. The theory recently advanced by Mr. Elliott in the "Ibis," of its being the young of the sparrow owl [*Nyctale Tengmalmi*] I do not think at all probable; I have the two side by side

and cannot observe any resemblance to warrant such a conclusion, the difference in size alone being sufficient to show the distinction. My own opinion is that it will be found to be the young of the saw-whet; but is it not possible that they do not all assume the same garb — that there may here be a freak of nature, so to speak, such as there is in the case of the screech owl, where we find both red and gray." — J. A. A.

Variation in the Tarsal Envelope of the Bald Eagle. — Having observed in Baird's work and elsewhere remarks upon Audubon's plate of the "Washington Eagle," as well as upon his statement, "scutellation on tarsus and toes uniform for their whole length," I have thought that the results of my observations on Nova Scotian eagles may be considered pertinent. I soon found scutellation valueless as a specific character; differing in details in almost every specimen, and often unlike on the two legs of the same specimen. In a series of thirty or forty specimens, I found in some the tarsus crossed in front by five or six large scales; in others the scales successively decreased in size by one-fourth, one-third, and one-half; and in the others again become almost obsolete. The tarsal scutella differ from those of the toes in being immovable in their mutual relations, the phalangeal ones sliding under each other when the toes are extended. There are eleven to thirteen on the middle toe, about eight on the outer, and five on the inner and head toe respectively; they appear to vary less than the tarsal ones do. Now about the figure of "*Haliætus Washingtonii*." The bird is drawn standing on a flat rock, which throws the toes forward, causing the tarsal and phalangeal scutellation to *appear* continuous; at least they would so appear, from the point of view presented, unless an engraver were particularly careful. Any bald eagle with well developed tarsal scales would show about the same thing under the same circumstances. Audubon's text is not so easily explained; but as he must have known that it was impossible for the stationary scales of either tarsus or toes to slip so as to meet each other, we may conclude that he meant "scales continuous the whole length of *each*." But the question of the validity of "*H. Washingtonii*" does not rest entirely upon the accuracy or the reverse, of delineation and description. It is only for a few years that four positive species — *pelagica*, *albicilla*, *leucocephalus* and *Canadensis* have been discriminated

among the mass of "sea," "bald," "golden," "gray," "ring-tailed," etc., eagles stated to inhabit this country. All the gray or brown eagles from Nova Scotia that have passed through my hands are young bald eagles. One measured nearly eight feet across; another 8½ feet; exceeding some balds by over a foot. One had the tail 15½ inches; in another the curve of the bill was 3½ inches, and tarsus the same. These measurements rival and even outdo "Washingtonianus" except in extent of wing.—J. Bernard Gilpin, M. D., *Halifax, N. S.*

[Note. Dr. Coues, to whom we referred this paper, says:—"Dr. Gilpin's remarks upon the variation of the scales are interesting, and may be new to many; while I for one am satisfied with his explanation of Audubon's figure and statement. I wonder how many more times the "Washington Eagle" must be put down before it will stay down! As a species, it is a myth; as a specimen, it was a big, youngish bald eagle – the two-year-olds of which, before getting the white head and tail, are *usually* larger than the mature birds. Of the five eagles given by late authority, the Washington goes under, as just said; *pelagica* is a N. E. Asiatic species, not yet authentically of this country; *albicilla* Greenland and N. European species, *ditto*; leaving *Haliætus leucocephalus*, the bald eagles, always known by naked tarsi; and *Aquila chrysætus* (Canadensis), the gold eagle, with entirely feathered legs, as our only valid authentic species." See Key N. A. Birds, p. 219, 220. — Eds.]

The Colorado Potato Beetle Varying its Food. — A generally received opinion in regard to the Colorado Potato Beetle, *Doryphora* 10-*lineata* (Say), is that its food is confined to plants of the family Solanaceæ. I have found it this season (June 19, 1872) at Port Austin, Michigan, sparingly feeding on grass, on which it had also deposited its eggs. Later in the season (July 20), at Fort Gratiot, Michigan, I encountered it in large numbers, in both the larva and perfect states, in the vicinity of potato-fields (where it had committed terrible depredations), devouring the younger leaves and flower buds of the common thistle (*Cirsium lanceolatum* Scop.), which it was rapidly stripping even to its thick stem so that the entire top of the plant hung down, almost severed. In the same neighborhood I also saw it on pigweed (*Amarantus retroflexus* L.), hedge mustard (*Sisymbrium officinale* Scop.), the cultivated oat, smart-weed (*Polygonum hydropiper* L.), and the red currant and tomato of the gardens, as well as the common night-shade (*Solanum nigrum* L.), the last two its more legitimate food. But of the last mentioned plants, with the exception of the night-shade, it ate only the young leaves, and of them very sparingly. The thistle it seemed particularly to relish. Could its attention be diverted from the potato to the Canada thistle it would encounter an object worthy of its prowess; and the curses which have

been heaped on its striped back would be turned to blessings. But, I fear, little good can be hoped from the capacity, thus evinced, to diversify its food, and so accommodate itself to circumstances. This can only be regarded as another obstacle in the way of its extermination.

Since writing the above I have found the beetle feeding on the maple-leaved goosefoot (*Chenopodium hybridum* L.), lamb's quarters (*C. album* L.) and thoroughwort (*Eupatorium perfoliatum* L.); and August 8, 1872, I saw it in the larva and perfect states, voraciously eating the black henbane (*Hyosciamus niger* L.), on which was also to be be seen an abundance of the eggs.—HENRY GILLMAN, *Detroit, Michigan, September*, 1872.

THE SENSES OF SIGHT AND HEARING OF THE WILD TURKEY AND THE COMMON DEER. — At the foot of the bluff on the Vermilion River, I saw a flock of wild turkeys crossing on the ice and coming directly towards me. I concealed myself in a very dense thicket and awaited their approach. Though concealed by the thick brush I knew by the sound, that they were passing very near me, and going towards an open space on the brow of the bluff within easy shot. I rested my gun against a small tree, my head and arms only exposed, intently looking for the appearance of the game. The first that appeared was the head and neck of the leader of the flock, which he seemed to raise above the cover for the express purpose of looking at me, for he instantly stared directly toward me and gave the loud quick note of alarm. In a second or two he, with the rest, took wing, but, as if still in doubt, he flew near enough over me for a better observation. Evidently they did not smell me when they passed. The leader's attention was not attracted by the least motion. Before I had taken down my gun I heard the brush crack, and in an instant a large buck stopped so near me that I could see his form distinctly, but the brush was too thick to justify a shot. He stared at me for some seconds and then, seeming to become reassured, bounded on, when he soon passed through an open space and I shot him.

His attention had evidently been directed towards me by the sense of smell, but seeing no motion his fears became allayed.

The vision of the wild turkey is very acute but the sense of smell is very dull. Exactly the reverse is the case with the deer. —J. D. CATON.

THE ANT-LION.—While in the Indian Ladder Region, Albany Co., N. Y., in August, 1871, I found a large colony of ant-lions. It is situated near the head of the "Ladder Road," at the base of the cliffs and extends for several rods along the path to the "Tory House." The cliffs here hang over the paths, so that it is almost impossible for rain to reach the spot. The soil is composed of disintegrated limestone, extremely fine, but mingled with minute fragments of stone as well as larger pebbles.

In Aug., 1871, the colony numbered rather more than 600 individuals, but on July 6, 1872, there were scarcely half that number. Perhaps at this last date some were in the chrysalis, as of several specimens thus obtained most of them entered that state in a short time, while those taken in August remained until the following spring.

Food was very scarce in this colony, as it was rare to see more than four or five victims in the lions' dens at one time. On several occasions I noticed a strong and active insect, having ventured over the edge of the pit, run swiftly down and up the other side, leaving the ant-lion wildly snapping its jaws, as the intended victim mounted the steep side of the pitfall.

The ant-lion does not, so far as my observation goes, throw up sand to bring down its prey, but throws it up in every direction in order to keep its jaws free to seize the insect when it reaches the bottom of the den.

In 1871 there was another colony (which I did not visit in 1872) near the "Paint Mine." It consisted of some 300 members. I call it a colony, although, of course, there was no friendly intercourse between the inhabitants of the settlement. On the other hand, in the most crowded portions, the chief employment of the insects was to throw out the dirt which their active neighbors were depositing on their own premises.—E. A. BIRGE, *Williams College*.

CLASSIFICATION OF THE COLEOPTERA. — The true classification of insects makes slow but steady progress. Although easily observed, the beetles have not been so well arranged heretofore as in the recent system of George R. Crotch, who proposed to divide the *Coleoptera* into *Rhynchophora* and *Coleoptera* proper, following out the sketch made by Dr. Le Conte in 1862. *Coleoptera* proper in turn are subdivided into two parallel series, the *Isomera* and

Heteromera, characterized principally by the number of the tarsal joints and other characters of less moment; the *Isomera* are again divisible into two parallel series, known generally as *Pentamera* and *Tetramera* though the names are not rigidly exact. The *Pentamera* embrace the bulk of the Coleoptera, and contain all the abnormal tarsal variations; this section was subdivided into five series, the *Adephaga* (second ventral segment visible at the sides); *Clavicornes* (antennæ normally clavate, tarsi variable); *Lamellicornes* (antennæ lamellate, anterior coxal cavities closed); *Serricornes* (antennæ pectinate or serrate, anterior cavities open); Detailed characters were added for the families of *Clavicornes*, which were divided into three main groups characterized by the development of the anterior coxæ, which are prominent and contiguous in *Silphidæ*, etc., globose and separate in *Erotylidæ*, etc., and transverse and separate in *Nitidulidæ*, etc. The families *Rhyssodidæ* and *Othniidæ* were removed to the *Adephaga* and *Heteromera* respectively (Proceedings of American Philosophical Society, January 7, 1873).

Do Rattlesnakes Climb trees? — In the attractive volume entitled "The Animal Creation;" by T. Rymer Jones, New York, 1873, we find the author asserting that "they do not climb trees;" but on the preceding page, p. 291, we find the rattlesnake figured as wrapped, constrictor-like, about a good sized tree. The figure itself is poor, and gives the impression of a serpent ten or twelve feet long; but more noticeable is the fact that the text and illustration do not agree. Which is the more correct? On this subject, we have but to say, that we have seen the *Crotalus horridus* crawl up the body of an oak that had grown out from a hillside, in an oblique position. The snake kept his entire length upon the upper side of the trunk of the tree, and finally coiled himself up at the point of departure of the main branches. Here he was partially concealed and had sufficient "room to spare," to dart half his length and seize any bird or squirrel that approached. To this extent, we know that rattlesnakes do climb trees, but not in the manner given in the illustration referred to; and we should judge that Mr. Jones' assertion that they "do not climb" was also incorrect. — Chas. C. Abbott, M. D.

Destruction of Dragon-flies by Birds.— Mr. Gould, in a communication to the Entomological Society of London, says, "I be-

lieve that the larger dragon-flies are very liable to the attacks of birds, and have no doubt that the hobby and kestrel occasionally feed upon them; with regard to the small blue-bodied species (Agrionidæ) frequenting the sedgy bank of the Thames, I have seen smaller birds, sparrows, etc., capture and eat them before my eyes, after having carefully nipped off the wings, which are not swallowed. This must take place to a considerable extent, as I have observed the tow-path strewn with the rejected wings." This has been observed by Mr. J. L. Hersey of New Hampshire (see the following note):—EDS.

BEES AND KING-BIRDS.—For the last ten years I have carefully noted the habits and movements of the king-birds, and have come to the following conclusion, viz: that they do eat the honey bee, and so does the purple martin; but instead of being destroyed for it, they should be protected and allowed to build their nests near the farm-house, because they drive off the hawks, crows and other plundering birds from the poultry yard. Warm afternoons in July and August, when the drone bees are out, we have seen the martins come down within ten feet of the hive and snap up the drone bees, thus relieving the workers from the necessity of expelling them from the hive and biting off their wings to prevent them from getting back to the hive. The king-bird also, we find, selects the drone, and will come afternoons and take his position on a stake in front of the hive, and when a drone bee comes along will make a rush for him, come back to the stake, give him a pick or two and swallow him. But says an objector, "What do they subsist on before the drone bees fly out?" This point I settled by shooting one in the month of May, and I found in his crop the wings and legs of May-bugs. By watching their movements, I find the dragon-fly is also a favorite food for them.—J. L. HERSEY, *American Bee Journal.*

COLOR OF THE EGGS OF CAPRIMULGINÆ.—In the paper of Dr. Elliott Coues in the NATURALIST of June, referring to the eggs of the *Antrostomus Nuttallii*, he speaks of it as a "singular circumstance" that its eggs should be white and adds that it is "a thing before unknown in this genus." In confirmation of his belief in the singularity of the absence of spots in the eggs of Nuttall's whippoorwill Dr. Coues refers to Dr. Sclater's generalization that all *Caprimulginæ* lay colored eggs.

We have in this instance another striking exemplification of the danger of hastily laying down rules from isolated facts. The real fact is, so far as we now know, there are as many species belonging to the genus Antrostomus that lay white unspotted eggs as there are that have colored ones. The eggs of Nuttall's whippoorwill were first obtained by Mr. Robert Ridgway, who met with them, July 20, 1868, among the East Humboldt Mountains, and the unspotted character of their eggs has for some time been a well known and undisputed fact.

But this is not the first instance of the discovery of an unspotted egg of an Antrostomus. In the third volume of the first series of the Ibis, page 64, Mr. Salvin mentions taking, April 20, 1860, on the mountains of Santa Barbara, in Central America, a species of Antrostomus with two white eggs. Mr. Salvin has since informed me that the parent of these white eggs has been ascertained to be *A. macromystax* of Wagler.

So far as we now know two of this genus, *Carolinensis* and *vociferus*, have eggs with purple marbling on a white ground, and two have purely white eggs. Occasionally the eggs of *vociferus* are almost immaculate. It is quite possible that the other southern forms of Antrostomus will be found to have unspotted white eggs and that the markings of the more northern species are the exceptions and not the rule.—T. M. Brewer.

More Monsters.—The account of a double pig in the June number of the Naturalist (page 567) leads me to say that there are now in my possession awaiting examination the following malformations.

1. A double pig, apparently identical with that above referred to; the brains are perfectly preserved.
2. A pig more nearly double, the two individuals being joined only by the thorax.
3. A child with two heads, three legs and a rudimentary third arm; of this the viscera including the two brains are preserved.
4. Four calves with two heads each; from two of these the brains are preserved.
5. A cock and a hen full grown, and possessing four legs each.
6. A young chick with one leg.
7. A fœtal pig with seven toes on each manus and six on each pes.

8. The manus of an adult pig with a well formed pollex.
9. A silver fish with partly divided tail.
10. A cat with only one kidney and one cornu of the uterus.
11. A pup, one day old; with no tail, single cloacal opening and one kidney only one-fifth the size of the other.— BURT G. WILDER.

THE DEPTHS OF MID OCEAN.— In her voyage from Teneriffe to St. Thomas the British Exploring Ship "Challenger" sounded and dredged every other day. The soundings showed that a pretty level bottom runs off from the African coast, deepening gradually to a depth of 3,125 fathoms at about one-third of the way across to the West Indies. If the Alps, Mont Blanc and all, were submerged at this spot, there would still be half a mile of water above them. Five hundred miles farther west there is a comparatively shallow part, a little less then two miles in depth. The water then deepens again to three miles, which continues close over to the West Indies. At the deepest spots both on the east and west side of the Atlantic, the dredge brought up a quantity of dark red clay, which contained just sufficient animal life to prove that life exists at all depths. No difficulty was experienced in obtaining these deep-sea dredgings, and it was merely a question of patience, each haul occupying twelve hours. In depths over two miles little has been found, but that little was totally new.— *Nature.*

A CAT'S JUMP. — The following statement, of the distance leaped by a cat, is made by the Messrs. Sanford Brothers, of Ithaca, N. Y., who are not only reliable but accurate observers of the doings of animals. "When our cat was about a year old, he was seen on several days to take position upon a show-case four feet high, and to watch a canary in a cage hanging from the ceiling eight feet from the case; the ceiling was eleven feet from the floor; and the cage an ordinary cylindrical one. One day, as we were observing him thus engaged, he suddenly sprung at the cage and caught his claws upon it; his weight swung the cage up against the ceiling, spilling all the vessels, and terrifying the canary; after swinging to and fro several times, the cat dropped to the floor uninjured; we measured the distance from the top of the case to the cage and found it to be ten feet; so that the cat made an ascent of six feet in eight, or upon an incline of nearly thirty-five degrees." — B. G. WILDER.

ŒSTRUS HOMINIS IN TEXAS. — I have in my possession a larva supposed to be that of *Œstrus hominis* Gmelin; if it is not, it is evidently very closely allied to that. It was taken from an ulcer on the shoulder of an eight-year old boy, of our village, on the 15th inst., by his mother, and given to the family physician, Dr. M. H. Oliver, through whose kindness I was put in possession of it. It is a whitish grub, about $\frac{1}{3}$ of an inch in length, somewhat wider than thick, the constrictions between the segments are well marked, the cephalic hooks and anal stigmata are visible. It has the appearance of not being fully grown. It is interesting from the fact that, according to the "American Entomologist," no fly belonging to this family has heretofore been known to attack man within the United States. — S. J. STROOP, *Waxahachie, Ellis County, Texas, January* 22, 1873. [Having received Mr. Stroop's specimen, we may say that this is not the larva of *Œstrus hominis*, but of the sheep bot fly (*Œstrus ovis*), or a closely allied species.—EDS.]

AGRICULTURAL ANTS.—Mr. Moggridge has observed at Menton, France, two species of ants (*Aphenogaster*) carrying into their nests, during the winter months, the seeds of certain late fruiting plants. He has traced their burrows to a spherical chamber filled with the seed of a grass which he had seen the ants in the act of transporting. "Outside the channels there was generally a heap of the husks of the various seeds, and sometimes one of those heaps would fill a quart measure. These husks had had their farinaceous contents extracted through a hole in one side. He purposely strewed near the nests large quantities of millet and hemp seeds. After the lapse of a fortnight many of these seeds, previously conveyed into the nests, had been brought out again, they having evidently commenced to germinate, and he then found that the radicle was gnawed off from each seed, so as to prevent further growth, and, this being effected, the seeds were carried back again. The cotyledons of germinated seeds were removed from the nest."— *Trans. Entomological Society of London*, 1871.

METAMORPHOSES OF BUTTERFLIES. — Dr. Burmeister has forwarded to Paris a fine series of drawings illustrating the earlier stages of the magnificent South American Morphos and Pavonias; many details of their external anatomy are also represented. They will be published in the "Revue et Magazin de Zoologie" and will supply a great deficiency in our knowledge of the metamorphoses of butterflies.

ANTHROPOLOGY.

An Indian Carving.—At a recent meeting of the Essex Institute, Mr. F. W. Putnam exhibited a very interesting carved stone which he had received from Dr. Palmer of Ipswich, who stated that it had been found at Turkey Hill, Ipswich.

This stone was evidently carved with care for the purpose of being worn as an ornament, and was probably suspended from the neck. It is of a soft slate, easily cut with a sharp, hard stone. The markings left in various places by the carver, showing where his tool had slipped, indicate that no very delicate instrument was used, while the several grooves, made to carry out the idea of the sculptor, indicate as plainly that the instrument by which they were made, had, what we should call, a rounded edge, like that of a dull hatchet, as the grooves were wider at the top than at the bottom, and the striæ show that they were made by a sort of sawing motion, or a rubbing of the instrument backwards and forwards. In fact, the carver's tool might have been almost any stone implement, from an arrowhead to a skin scraper, or any hard piece of roughly chipped stone.

Figure 114 represents the stone of natural size, its total length being two and a half inches. It is of general uniform thickness, about one-fifth of an inch, except where the angles are slightly rounded off on the front of the head and on the abdominal outline, and the portion representing the forked tail, or caudal fin, which is rapidly and symmetrically thinned to its edges, as is the notched portion representing the dorsal fin.

Fig. 114.

Carved Stone from Ipswich, nat. size.

The carving was evidently intended to represent a fish, with some peculiar ideas of the artist added and several important characters left out. The three longitudinal grooves in front represent the mouth and jaws, while the transverse groove at their termination gives a limit to the length of the jaw, and a very decided groove on the under side divides the under jaw into its right and

left portions. The eyes are represented as slight depressions at the top of the head. The head is separated from the abdominal portion by a decided groove, and the caudal fin is well represented by the forked portion, from the centre of which the rounded termination of the whole projects. In this part there is an irregularly made hole of a size large enough to allow a strong cord to pass through for the purpose of suspension. The portion of the sculpture rising in the place of a dorsal fin is in several ways a singular conception of the ancient carver. While holding the position of a dorsal fin, it points the wrong way, if we regard the portion looking so much like a shark's tooth as intended to represent the fin as a whole. It is very likely that the designer wished to show that the fin was not connected with the head and, as he was limited by the length of the piece of stone, after making the head so much out of proportion, he was forced to cut under the anterior portion of the fin in order to express this fact. If we regard it in this light, the notches on the upper edge may be considered as indicating the fin rays; but the figure best shows the character of the sculpture, and persons interested can draw their own conclusions.

The symmetry of the whole carving is well carried out, both sides being alike, with the exception that the raised portion at the posterior part of what has here been called the dorsal fin is a little more marked on the left side than on the right, and the edge on the same side is surrounded by a faint, irregularly drawn line.

The carving was unquestionably made by an Indian of the tribe once numerous in this vicinity and, as it was almost beyond a doubt cut by a stone tool of some kind, it must be considered as quite an ancient work of art; probably worn as a "medicine," and possibly indicated either the name of the wearer or that he was a noted fisherman.

Discovery of a New Human Skeleton of the Palæolithic Epoch in Italy.—M. E. Rivière describes (*Comptes Rendus*, 1873, Part 16, 1027) the remains of a second fossil human skeleton from the sixth cave of Baoussé — Roussé (Grottes de Menton), Italy. The skeleton was found at a depth of nearly four metres below the floor of the cave, lying extended on its back in the longitudinal direction of the cave. The deposit forming the floor is regularly stratified, and consists of charcoal, ashes, of small calcined angular stones, bones and teeth of animals, shells and flints. Associated

with the remains were numerous flint implements and a few worked in bone, as well as a number of perforated shells belonging to the genera *Nassa*, *Buccinum*, *Cypræa*, etc.; these, from their position, had evidently formed parts of a necklace and bracelets, and were interred with the body. The extreme friability of the bones did not allow of their removal in so perfect a condition as that of the first skeleton, but, in this case also, they belonged to a tall individual, the skeleton measuring nearly two metres in length. In the débris of the cave, bones of the following animals were met with:— *Ursus spelæus*, *Hyæna spelæa*, *Canis lupus* and *vulpes*, *Arctomys primigenia*, *Lepus cuniculus*, *Mus*, *Equus caballus*, *Sus scrofa*, *Bos primigenius*, *Cervus Canadensis*, *Elaphus corsicus* and *capreolus*, and *Capra primigenia*. Besides there were found some bones of a large eagle and of some birds of passage, as well as numerous species of marine shells of the genera *Patella*, *Pectunculus*, *Mytilus*, *Pecten*, *Dentalium*, and *Trochus*.— *The Academy*.

MICROSCOPY.

Apertures of Objectives.—The full report having been received of the London examination of the Tolles' $\frac{1}{10}$ inch objective sent there for measurement, it appears that unfortunately the examiners were thrown off their guard by an unexpected element in the case, and that, incredible as it may seem, their report does not touch the real question at issue. Everybody knows that an objective with cover-adjustment possesses a certain range of powers and angular apertures; and no one doubts that Mr. Tolles can make an objective of 145° aperture in air, or that the corresponding apertures would be 91° in water and 79° in thinned balsam. The one question in regard to this objective is not its balsam angle at an adjustment, dry, upon an accidentally or arbitrarily chosen object and the corresponding immersion angles, but its balsam angle at its highest (working) adjustment. If, from faulty mounting, the adjustment can be screwed past the limit of good definition, then of course it ceases to be an achromatic objective at all, and its angle beyond such limit is not worth talking about. The examiners do not state, however, that they examined the combination at its highest available angle dry, still less at its highest available angle immersed. Mr. Tolles' prominence as a successful maker of objectives gives a certain value to his statements even when they seem arbitrary; and it is to be hoped that

the secret of his peculiar belief in this case may be fully studied out, notwithstanding the unscientific method which he has chosen, in this instance, of appealing from principles to facts.

The principle involved in this discussion has long been understood. An objective varies in working focal length, and in angular aperture, according to the medium through which it works; and this variation has a definite ratio to the refractive indices of the media compared. By a simple and undisputed mathematical computation, the sine of the semi-aperture in air is to the sine of its semi-aperture in another medium, as the index of refraction of that medium is to the index of air: or, as the index of air is unity, the sine of its semi-aperture in any medium is equal to the sine of its semi-aperture in air divided by the index of the other medium. This theoretical ratio is easily verified by experiment, as instanced by Mr. Brakey in the case under consideration, where an angle of 145° in air should give a fraction over 91° in water and 79° in balsam so thin that its index was an arithmetical mean between that of balsam and that of turpentine, while in hard balsam having an index of 1.549 its aperture would have fallen to 76°. As the angle in air approaches the extreme limit of 170° or upwards, the balsam angle rises so slowly that the above 79° would scarcely reach 83°, the extreme angle for pure balsam being necessarily still smaller. This reasoning assumes only that the extreme ray above the front combination, capable of entering into the image when the objective is worked dry, is the extreme also when adjusted for immersion work.

Mr Tolles has uniformly declined either to accept or to controvert this well known theory, preferring simply to offer proof of his ability to excel this limit, without reconciling such result with the mathematical doctrine. Whether he utilizes rays beyond the extreme ray dry, or whether he measures rays not capable of forming a (good) image he does not state, and we can only conjecture. His early publications seem to claim "collecting" power for more extreme rays; but his letter to the March number of the Monthly Mic. Jour. practically disclaims this doctrine, and hints at a higher refracting power than crown glass has, in the front lens, as the secret of his excessive angle. Curiously this letter happens to be published in the same number with Mr. Brakey's explanation that the result is independent of the quality of the first lens, its index of refraction occurring twice in the computation in such positions as to cancel itself.

Mr. Wenham evidently does not recognize the possibility of "collecting," by means of posterior combinations, rays more divergent (behind the front lens) than those which are extreme when the objective is worked dry; and Mr. Tolles distinctly disavows this theory for his side of the controversy: yet it seems neither absurd nor improbable, and it is most likely the expedient by which the balsam angle is to be increased beyond 82°.

Since the above was in type Dr. J. J. Woodward has published an important contribution on this subject in the Monthly Mic. Jour. A $\frac{1}{10}$ was sent to him in February by Mr. Tolles for examination. It gave good definition, through glass one seventy-fifth of an inch thick, at its point of highest cover-adjustment; but at such adjustment its aperture could not be satisfactorily measured by the tank method. He therefore contrived an ingenious modification of the card-board method, throwing parallel solar rays through the objective from above, and measuring, in a darkened room, the inverted cone of a light below the focus of the objective, by bisecting this cone of light with a thin flat tank filled with balsam or other medium, the objective being attached, immersion fashion, to the surface of the medium. The illuminated portion of the medium was easily seen and measured. This method gave a balsam angle of not over 80° to the $\frac{1}{10}$ sent to him by Tolles for measurement, as well as to other Tolles' lenses previously furnished by that maker. On being apprised of this result Mr. Tolles sent a $\frac{1}{5}$, which gave a balsam angle of 90° to 100°, according to adjustment. This objective was peculiarly constructed, having four combinations instead of three; it could not be worked dry, nor could it work through any but a very thin cover. Dr. Woodward, and Prof. Simon Newcomb and Mr. Renel Keith, who examined the lens with him, attributed the excessive angle to the cause already alluded to, the employment of rays, which if the lens were worked dry would be beyond the limits of transmission, and would therefore suffer total reflection.

Mounting in Balsam.—Mr. W. H. Walmsley's success in mounting objects gives great value to his practical suggestion contributed to Science Gossip. He regrets that beginners should be confronted with spring clips, spirit lamps, and over-heated balsam, when balsam, dried to the point of brittleness and then dissolved to the consistency of rich cream in chemically pure benzole, would obviate the necessity for such annoyances. He frees the speci-

men from moisture by drying or preferably by passing successively through weak and absolute alcohol, treats it with oil of cloves which is more desirable than turpentine because more readily miscible with balsam and not calculated to harden the specimens even if they are left in it for a long time, transfers it to the slide and arranges it with needles, places a drop of the balsam solution on it and applies the glass cover in the usual manner. In a few days the mount will be sufficiently hardened to be handled with safety, especially if after twenty-four hours it should be slightly warmed and the cover carefully pressed down with the forceps and held down with a small weight. The best finish for the edge of the circle he finds to be the same balsam that is used in mounting, laid on with a camel's hair pencil; since this is neat and handsome, and will not spoil the specimen by running in, as may happen with colored varnishes.

Unmounted Microscopic Objects.—Mr. Jno. H. Martin, of Week street, Maidstone, England, is supplying a great want of microscopists by furnishing unmounted objects for the use of amateurs. His price for two dozen objects, post free, to the United States, is one dollar.

Resolution of Frustulia Saxonica into Rows of Dots. After my new Tolles $\frac{1}{50}$ immersion had resolved the lines of *Amphipleura pellucida* into beading, I succeeded in obtaining a slide of *Frustulia Saxonica*, mounted dry by J. D. Moller. This test is somewhat easier than the *Amphipleura*, but more difficult dry than *Grammatophora subtilissima* is in balsam, or at least I find it so by lamp light, although both are satisfactorily shown. The following measurements were made with the Tolles $\frac{1}{50}$ objective, No. 2 eye-piece, and camera lucida; amplification 4000 times.

Using an ammonio-sulphate of copper cell and sunlight, the transverse striæ of the *Frustulia* are brought out without the least difficulty. The average number of lines to the thousandth of an inch, in fifteen measurements on different frustules, was eighty-nine. This agrees essentially with the counts of Dippel and Dr. Woodward.

I also succeeded in bringing plainly to view longitudinal lines which were counted in the same way. The average of fifteen counts was ninety-five to the thousandth of an inch. The lowest number observed was eighty-eight, the highest one hundred.

These lines I found more difficult than the transverse ones on *Amphipleura pellucida*, but patent enough to be accurately counted. It appears then that Dr. Woodward was correct in regarding the longitudinal striæ of Dippel as diffraction phenomena, for they were much coarser than the true lines, being as given by him only about 50,000 to the inch.

Thus far everything was done with ease. Then with care the bright apparently raised lines were transformed into rows of beads, this resolution into dots being accomplished in a satisfactory manner.

The results stated above have been repeatedly verified. I also resolve into beads, with the $\frac{1}{50}$, *Navicula crassenervis*, *Striatella unipunctata* and any *Pleurosigma*.— G. W. Morehouse.

Mould on Bread.— Messrs. Rochard and Legros express the belief, in "Comptes Rendus," that this frequent parasitic vegetation is due rather to the poor quality of the flour, or to bad management, than to the presence of germs in the air, and that it may be prevented by adding an excess of salt to the bread.

Effects of Dyeing Wool.— M. Dumas has been investigating the question whether wool, and similar hairs, are penetrated by the coloring material, or only colored externally in the process of dyeing. In fresh wool he found all the layers perfect; but in bleached wool the outer or cortical layer was marred or destroyed. Fibres dyed with indigo, without boiling, contained granules of the coloring matter between the cells; while hairs which had been boiled in alumina and iron solutions appeared twisted or corroded.

Microscopic Eyes.— In the absence of any further information, and indeed in spite of any possible information, the newspaper story of the boy with microscopic eyes may safely be regarded as a curious hoax, founded on the magnifying power of shortsighted eyes as compared with longsighted ones. One eye may be calculated to form an image twice as large as another eye, or, by an extraordinary deformity, several times as large; but it would be no longer a human eye if capable of giving the high powers of the microscope. That the author of the hoax did not even aim at consistency or plausibility is seen in the representation that the boy was able to use for ordinary purposes the eyes that were capable, unaided, of resolving diatoms.

Economical Value of Raphides.—Mr. F. C. S. Roper suggested to the Eastbourne Nat. Hist. Soc. the value of raphides as tests of the genuineness of certain medicinal substances obtained from plants containing them. Though not new, this method of detecting adulterations or falsifications is capable of a greatly increased usefulness.

Pathology of Malignant Tumors.—Dr. W. B. Neftel, in a contribution to the Archives of Scientific and Practical Medicine, advocates the doctrine that cancer is primarily a purely local disease, due to mechanical or chemical irritation. Thus we notoriously find it usually originating in localities most constantly subject to such causes. Afterwards it becomes generalized by means of the lymphatics and blood vessels, and affects other and distant organs; and the unsuspected promptness with which this takes place occasions the frequent failure of local curative treatment. The existence of a hereditary disposition to malignant tumors, not in the congenital acquisition of morbid germs, but in the inheritance of a faulty structure or arrangement of tissues or organs, which thus offer less resistance to the causes of disease, is not denied, but is believed to have been greatly exaggerated.

Vitality from Germs.—As a reaction from the always fascinating doctrine that organic germs of various kinds, when introduced into the system of larger animals, have a tendency to cause disease and destruction, it has been recently surmised, without attempt at proof, that such germs may actually impart and increase vitality.

Obituary.—Mr. James How, a well known philosophical instrument maker of London, formerly with George Knight and Son, of London, and lately successor to them, died suddenly, Dec. 8, 1872. Mr. How will be remembered for his skill in the use of the microscope, but especially for his prominence among those who took the lead in introducing students' microscopes of good quality and cheap price.

NOTES.

The meeting of the American Association at Portland next month bids fair to be one of the largest held for several years, and we understand that quite a number of titles of papers to be

read have already been entered. A number of the older members of the association, several of whom were unable to attend the western meetings, have intimated their intention to be present, which will add much to the scientific results of the session. The entomologists are also anticipating a full attendance, and anthropology will probably be well represented, while geology and general zoology will unquestionably be maintained in their usual force. Botany has for many years been but slightly represented, to the regrets of workers in other fields. Will not the botanists show their force this year? Section A will probably be largely represented, as heretofore, by many distinguished scientists. Particulars relating to the meeting are given in our advertising pages.

At the late Annual Meeting of the American Academy of Science and Arts, Boston, Prof. Asa Gray resigned the chair of President which he had held for the past ten years. The following officers were elected:— *President*, Hon. Charles Francis Adams; *Vice President*, Prof. Joseph Lovering; *Cor. Sec'y*, Prof. J. P. Cooke, Jr; *Rec. Sec'y*, Prof. E. C. Pickering; *Treasurer*, H. G. Denney; *Librarian*, Edmund Quincy; *Council:* Class I, Prof. Benj. Peirce, Prof. Wolcott Gibbs and J. B. Henck; Class II, Alex. Agassiz, Prof. Asa Gray (in place of Prof. J. Wyman who declined reëlection), and Dr. Charles Pickering; Class III, Rev. G. E. Ellis, Hon. R. C. Winthrop and Prof. A. P. Peabody.

Science in Europe has met a great loss in the recent deaths of Baron Liebig, the distinguished chemist, and of De Verneuil, the French geologist and associate of Sir R. I. Murchison in the geological survey of Russia.

Lastly, who will say that John Stuart Mill, "the greatest living master of the purely inductive philosophy," did not exert an important influence on physical, as well as mental and political science, and anthropology, in its broadest sense?

The U. S. Fish Commission under Prof. S. F. Baird will spend the summer at Peak's Island, Portland Harbor. A large number of students and naturalists will assemble there, and the Commissioner's headquarters will form, as they have in the past, a most important school for the study of biology. A steam-tug has been provided by the government for dredging on an extended scale, and plans are on foot for deep-sea dredging.

THE "Scientific Correspondence" of Goethe was collected by Goethe himself, and will fill two volumes; it comprises the years 1812-32, though most of the letters appertain to 1822–27. There are letters addressed to Goethe by Blumenbach, Carus, Loder, Sömmering, Seebeck, d'Alton, Brandes, von Henning, Martius, Nees von Esenbeck, Purkinje, Wermburg, and Zschokke. It appears from them that Goethe kept up the most lively and detailed interest in the progress of science and natural history until the latest period of his life.— *The Academy.*

IT is with much pleasure that we record the recent munificent donation of one hundred thousand dollars to the Museum of Comparative Zoology made by Mrs. Quincy Shaw, a daughter of Prof. Agassiz. We have never seen a statement of the permanent funds of the museum, but are confident that a dozen or more similar donations would not come amiss, for the expenses of such establishments are much greater than is generally supposed.

WE notice with regret that the aquarial car which was conveying the living fish, oysters and lobsters to the Pacific coast only succeeded in stocking the river at Omaha with such of the animals as survived the fall through the bridge. Query.—How about the strength of the bridges on "the great continental highway?"

THE professorship of Natural History in Ann Arbor, lately vacated by Professor Winchell, has been filled by the election of Professor Eugene W. Hilgard of the University of Mississippi, a gentleman of the highest attainments and especially known in the scientific world from his reports on the geology of the Gulf States.

PROF. N. S. SHALER of Harvard College has been appointed State Geologist of Kentucky, his native state. Prof. Shaler is for the present in England. We learn from the daily papers that he has accepted the situation.

A fine chance is offered to any enterprising naturalist who wishes to test by experiments the theory of cave life, as the present proprietors of the Mammoth Cave offer to sell the cave and all its contents for the sum of $500,000.

THE distinguished botanist Wm. S. Sullivant died at Columbus, Ohio, on April 30th, aged 70 years.

BOOKS RECEIVED.

Transactions of the Massachusetts Horticultural Society for the year 1872. 8vo, pp. 192. Boston, 1873.

Geological Survey of Canada. Report of Progress for 1871-72. 8vo, pp. 154, with maps. Montreal, 1872.

List of Publications of the Geological Survey of Canada. 8vo. pp. 7. Montreal, 1873.

Tidsskrift for populære fremstillinger af Naturvidenskaben. Række 4, Vol. v, No. 1. 8vo, pp. 84. Kjobenhavn, 1873.

Archiv fur Anthropologie. Band V. Vierteljahrsheft 4. 4to. pp. 359-547. Braunschweig, Dec. 1872 *Correspondenz-Blatt der deutschen Gesellschaft fur Anthropologie, Ethnologie und Urgeschichte.* 4to. pp. 65-96. Nos. 9-12. 1872.

Proceedings of the Academy of Natural Sciences of Philadelphia. 8vo. Part III Philadelphia, 1872.

Annual Report of the Board of Regents of the University of Minnesota including the Geological and Natural History Survey of Minnesota, first Annual Report for the year 1872. By N. H. Winchell. 8vo. pp. 167, with maps. Saint Paul, 1873.

Additional Observations on the Dinocerata. By O. C. Marsh. 8vo. pp 4. (From Am. Jour. Sci. and Arts, Vol. v, April, 1873). New Haven.

A Contribution to the Ichthyology of Alaska. By Edward D. Cope. 8vo. pp. 9. (From Proc. Am. Phil. Soc., Feb. 17, 1873.)

On the Short-footed Ungulata of the Eocene of Wyoming. By Edward D. Cope. 8vo, pp. 37, With 4 plates. (From Proc. Am. Philos. Soc., Feb. 21, 1873.) Received March 20, 1873.

Catalogue of the Flowering Plants of Vermont. By George H. Perkins, 8vo. pp. 16. (From Archives of Science, Oct., 1872. Jan. and April, 1873.

The Mollusca Fauna of New Haven. By George H. Perkins. 8vo. pp. 55. (From Proc. Bost. Soc. Nat. Hist., Vol. xiii, Oct. 6—Nov. 3, 1869.)

The Mechanism of the Ossicles of the Ear and Membrana Tympani. By H. Helmholtz. Translated from the German by Albert H. Buck and Normand Smith. 8vo. pp. 69, with 12 illustrations. New York, 1873.

Views of Nature and the Elements,—Forces and Phenomena of Nature and of Wind. By Ezra C. Seaman. 12mo. pp 140 New York, 1873.

List of Elevations in that portion of the United States west of the Mississippi River. 8vo, pp. 47. Washington, 1873.

A List of North American Lichens. By Henry Willey. 12mo. pp. 30. Jan. 1873. New Bedford.

Supplementary Note on the Dinocerata. 8vo. pp. 2. (From Am. Jour. Sci. and Arts. Vol. v, April, 1873.

Report on a Second Deep-sea Dredging Expedition to the Gulf of St. Lawrence, with some Remarks on the Marine Fisheries of the Province of Quebec. By J. F. Whiteaves. 8vo. pp. 22. Montreal, Jan., 1873.

On the Action of Rhus venenata and Rhus toxicodendron upon the Human Skin. By James C. White. 8vo. pp. 27. (From New York Medical Journal, March, 1873.)

Notes on the Lingoa Geral or Modern Tupi of the Amazonas. By Chas. Fred. Hartt. 8vo. pp. 20. (From Trans. Am. Philol. Ass., 1872.)

Tidsskrift for populære fremstillinger af Naturvidenskaben. Fjerde Række. Femte Binds, Andet Hefte. Kjobenhavn, 1873.

John Torrey: A Biographical Notice. 8vo. pp. 11. (From Am. Jour. Sci. and Arts, Vol. v, June, 1873.)

First, Second, Third, Fourth and Fifth Annual Reports of the Secretary of the Connecticut Board of Agriculture for 1866, 1867, 1868-9, 1869-70, 1871-2 5 vols. 8vo. Hartford.

Notice of New Tertiary Mammals. 8vo. pp. 5. (From Am. Jour. Sci. and Arts, Vol. v. May, 1873. Received May 1st.

Oversight over det Kongelige Danske Videnskabernes Selskabs Forhandlinger og dets Medlemmers Arbeider. No. 3, 1871; No. 1, 1872. 2 pamphs. Kjobenhavn.

Bulletin de la Societe Imperiale des Naturalistes de Moscou. No. 2, 1872. Moscou.

Laven om homogene tunge Vædskers Tryk paa plane Arealer. By Adolph Steen. 4to. pp. 541-561. (From Vidensk. Selsk. Skr., 5 Række, Naturvidenskabelig og Mathematisk Afd., ix Bd. 7.) Kjobenhavn.

Bidrag til Kundskat om Egefamilien i Fortid og Nutid. By A. S. Orsted. (From Vidensk. Selsk. Skr., 5 Række, Naturvidenskabelig og Mathematisk Adf., ix, Bd 6.) 4to, pp. 335-538. With 8 plates and one map. Kjobenhavn, 1871.

Fifth Annual Report on the Noxious, Beneficial and other Insects of the State of Missouri. By Charles V. Riley. 8vo. pp. 160. Jefferson City, 1873.

Annual Report of the State Geologist of New Jersey for the year 1872. 8vo. pp. 44. Trenton, 1872.

Report of the Entomological Society of Ontario, 1872, *including a Report on some of the Noxious, Beneficial and Common Insects of the Province of Ontario.* By C. J. S. Bethune. 8vo. pp. 75, Toronto, 1873.

On the Strictures of Urethra. By F. N. Otis. 8vo, pp. 20. (Reprinted from the N. Y. Medical Journal. March, 1873.) New York, 1873.

Monthly Report of the Department of Agriculture for March, 1873. 8vo. pp. 131. Washington, 1873.

The Academy. London, May 15-June 2. 1873.

Canadian Entomologist. London. Vol. v, No. 4.

Revue Scientifique. Paris, May 17-June 7, '73.

The Field. London, May 17, 24, 1873.

Land and Water. London, May 17, 24, 1873.

Nature. London, May 15-June 5, 1873.

Bulletin of the Torrey Botanical Club. New York, May, 1873.

American Journal of Science and Arts. New Haven, June, 1873.

Journal of the Franklin Institute. Philadelphia, June, 1873.

Journal of Botany. London, June, 1873.

Popular Science Monthly. New York, July, 1873.

Newman's Entomologist. London, June, 1873.

APPENDIX

TO

THE AMERICAN NATURALIST,

JULY, 1873.

ON PROFESSOR MARSH'S CRITICISMS.

The recklessness of assertion, the erroneousness of statement, and the incapacity of comprehending our relative positions, on the part of Professor Marsh, render further discussion of the trivial matters upon which we disagree unnecessary; and my time is too fully occupied on more important subjects to permit me to waste it upon personal affairs which are already sufficiently before the public. Professor M. has recorded his views "*ære perenne*," and may continue to do so without personal notice by E. D. Cope.